APPLIED RESEARCH REPORT

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THE INFLUENCE OF SANDSTONE CHANNELS ON COALS FROM THE SYDNEY BASIN: MINERALOGY, CHEMISTRY, PETROGRAPHY, RHEOLOGY AND THERMAL CHARACTERISTICS.

FINAL REPORT

BY

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MICROMEDIA

SUMMARY

The influence of sandstone channels on coal quality was studied for three commercial seams (Hub, Harbour, Phalen) by comprehensive geochemical, thermal and petrophysical analysis of bench samples for six columnar sections from roof rock to seat clays.

For each seam, two sections were analyzed: coal overlain by sandstone roof; coal capped by shale roof.

Sandstone Influence

A. Pyritic Sulphur

1. Total sulphur increased at coal/rock interfaces with corresponding increases in Fe_2O_3. The sandstone capped columns exhibited higher sulphur concentrations throughout the seam. This enrichment was predominantly in the form of pyritic sulphur. Pyritic sulphur ratios increased (up to 78%) in sandstone capped columns with a corresponding decrease in organic sulphur.

2. Coal mineral analysis supported the total sulphur results, with an increase in sulphur bearing minerals under the sandstone roof: dominantly pyrite.

3. Organic sulphur concentrations were comparable in sandstone and shale capped columns with the exception of Harbour Seam. Here, reported "organic" sulphur doubled in the sandstone capped column, possibly due to an increase in fine-grained pyritic sulphur.

B. Major Elements

1. Ash content increased at coal/rock interfaces. This trend was mimicked by SiO_2 and Al_2O_3. The sandstone capped columns exhibited higher ash concentrations throughout the seam likely due to epigenetic pyrite.

2. The Phalen seam contained much higher CaO concentrations than other seams, corresponding to visible calcite. The sandstone capped column tended to be depleted in CaO directly under the roof, suggesting possible leaching by fresh water introduced by these channels.

C. Trace Elements: As

1. The sandstone capped columns contained higher values of arsenic than the shale capped coal. This correlates

with higher pyrite concentration which likely carries the arsenic in solid solution.

D. Coal Macerals

1. Organic composition was not affected by sandstone channels, however, visible mineral matter increased in sandstone capped columns.

2. Vitrinite reflectance (R_o) of the Harbour seam (sandstone roof) may have been affected by heat loss due to the presence of the channel. Here, R_o values were suppressed adjacent to the sandstone roof.

General Coal Quality

A. Petrography/Proximates

1. The coals of the Sydney Basin are classified as high volatile A bituminous coal, containing volatile matter greater than 31% and fixed carbon less than 69% (dry weight).

2. Moisture content was highest in the Hub seam and tended to be independent of roof rock composition. The Harbour seam contained the lowest moisture content.

3. Petrographically, the coals studied were bright-banded, with a tendency toward decreased vitrinite and increased intertinite and liptinite towards the top of the seam. This trend suggests possible drowning of the peat leading to seam termination.

4. Vitrinite reflectance values were lowest in the Hub seam (0.76%, 0.79%) and similar in the Harbour and Phalen seams (approximately 0.95%).

5. The stability factors for each seam range from 40 (Phalen seam) to 20 (Hub Seam). Average stability factors plot in the high volatile range, and suggest blending with coals of higher reflectance and intertinite content to improve the quality of coke produced.

B. Chemistry

1. Anomalous phosphorous values were reported in specific horizons in the Harbour and Phalen seams. These anomalies may be attributed to a concentration of fossil fish bones. Anomalous apatite was observed in the Harbour seam by SEM analysis to confirm these enrichments.

2. Substantial localized enrichments in many trace elements occurred in the top and base of most seams, independent of sandstone influence. Sandstone capped columns tended to possess similar or slightly lower average element concentrations with the exception of arsenic, iron and sulphur.

3. Arsenic and chlorine were enriched in the Sydney Basin coals when compared with average sedimentary rock concentrations. The Sydney coals also contained much higher arsenic concentrations when compared to average arsenic values in coals from around the world.

4. There were distinct element enrichments from one seam to another in the Sydney Basin. The Hub seam contained high values of elements such as As, Pb, Zn, Cu, Mo, Ni and Co. The Phalen seam tended to be enriched in Ba, Sr, P, Sn, Ga and Ge with high As, Cu, and Mo. The Harbour seam generally contained low average elemental concentrations with localized enrichments at top and base of the seam.

5. Rare earth elements correlated with Al_2O_3 content suggesting correlation with clay minerals. Whole coal concentrations reflected the ash content of the coal. No influence from sandstone channels was indicated.

RECOMMENDATIONS

This report contributes an extensive data base to the problem of paleochannels in bituminous coal mining. World literature is limited and the Sydney Basin could represent a significant scientific contribution. The present study did not allocate sufficient professional time to the interpretative stage. We recommend a follow-up contract to produce a more extensive scientific evaluation in the form of journal publications to benefit the international mining community.

Judith C. White, Hon. B.Sc.

Dr. Dieter Birk, P.Geol.

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NOTE: Average" defined in Appendix II
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Lynn Mills	

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RESTRICTIONS

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3. GEOLOGICAL SETTING

The Sydney Coalfield is located both onshore and offshore Cape Breton Island, in northeastern Nova Scotia (Figures 1). This saucer-shaped Carboniferous basin known as the Sydney Basin, extends across the Laurentian Channel, almost as far as Newfoundland (King and MacLean, 1976).

The productive seams occur in the Pennsylvanian Morien Group, which on the basis of megaflora and spore florule, has been assigned a Westphalen C and D age (Bell, 1938; Hacquebard et al., 1960). Figure 2 illustrates the stratigraphic sequence of coal seams in the Sydney Basin. This study examines channel sections from three seams namely:

1. Hub Seam - Prince Colliery
2. Harbour Seam - Lingan Colliery
3. Phalen Seam - Phalen Colliery

These seams were deposited in a floodplain environment, with large accumulations of organic matter transversed by north-east trending river systems (Duff et al., 1982). These rivers deposited sand, silt and clay beyond their natural levees, on top of the peat during heavy run-off periods. After burial and compaction, this led to stone partings within the coal. Sandstone channels also eroded into existing peat affecting seam height and hampering present day mining efforts. Figure 3 illustrates the distribution and orientation of such channels.

Interactions between fluvial sedimentation and peat accumulation also led to splitting of seams and subsequent termination in marginal areas of the coal swamps (Hacquebard et al., 1967).

4. PROBLEM AND SCOPE

a. Introduction

The occurrence of sandstone infilled, paleoriver channels in Cape Breton coal mines has perennially been a source of problems from a safety, productivity and coal quality point of view (Forgeron, personal comm.).

Continuous, underground mapping by geologists at the Cape Breton Development Corporation has indicated a linear northeasterly trending direction for these channels. The channels pose a problem when they occur within or in close proximity (generally less than five feet) to the roof of the coal seam (Forgeron, 1985). Figure 4 indicates the types of problems these features can create.

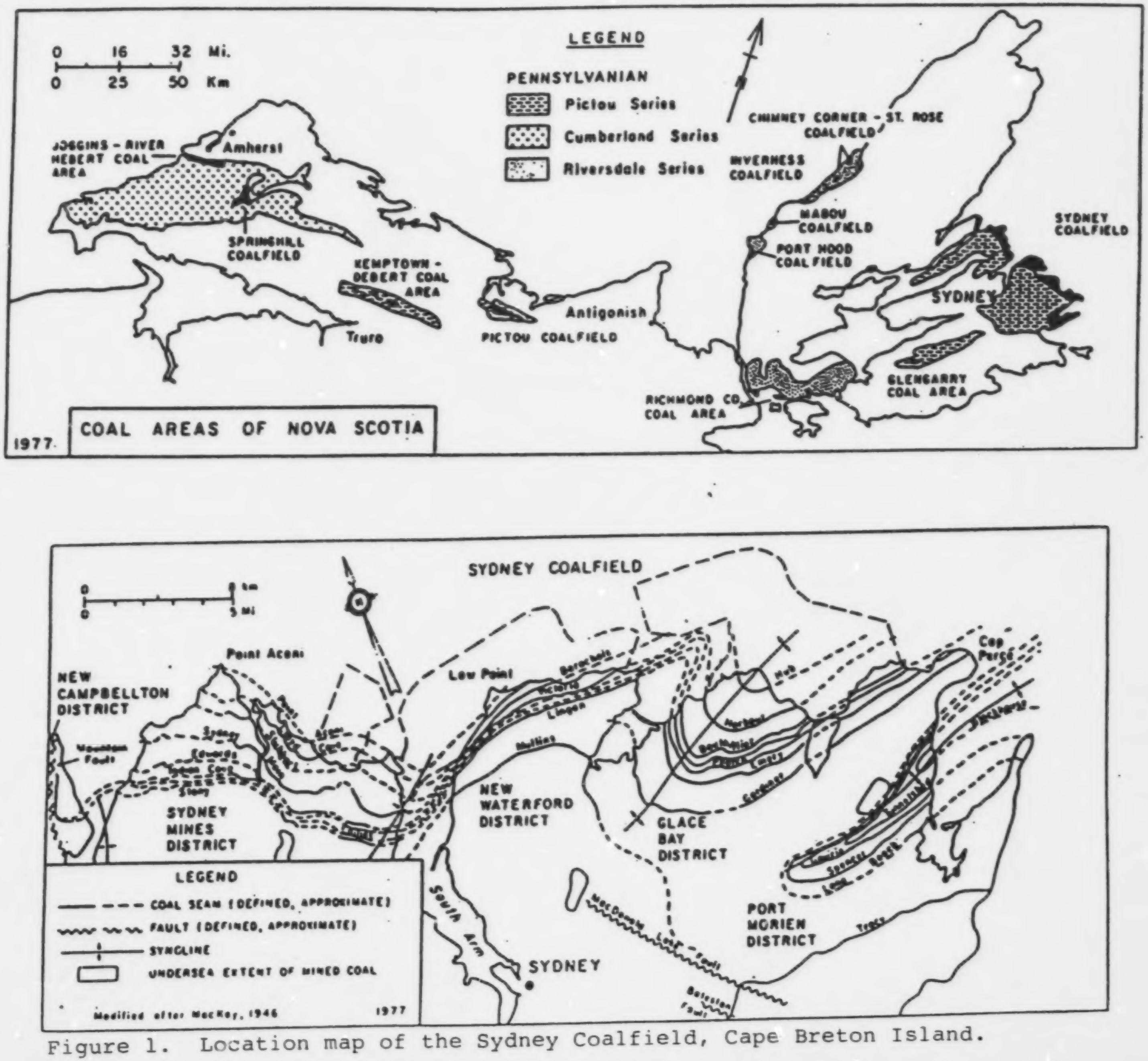

0 16 32 Mi.
0 25 50 Km
LEGEND
PENNSYLVANIAN
Pictou Series
Cumberland Series
Riversdale Series
JOGGINS - RIVER HEBERT COAL AREA
Amherst
SPRINGHILL COALFIELD
KEMPTOWN - DEBERT COAL AREA
Truro
PICTOU COALFIELD
Antigonish
CHIMNEY CORNER - ST. ROSE COALFIELD
INVERNESS COALFIELD
MABOU COALFIELD
PORT HOOD COAL FIELD
RICHMOND CO. COAL AREA
SYDNEY COALFIELD
SYDNEY
GLENGARRY COAL AREA
1977
COAL AREAS OF NOVA SCOTIA
SYDNEY COALFIELD
0 8 km
0 5 Mi
Point Aconi
Low Point
NEW CAMPBELLTON DISTRICT
Mountain Fault
Sydney
Edwards
Stony
SYDNEY MINES DISTRICT
Lingan
Mullins
NEW WATERFORD DISTRICT
Hub
Harbour
Phalen
Emery
Gardiner
GLACE BAY DISTRICT
Cap Percé
Spencer
Lorway
PORT MORIEN DISTRICT
Tracy
MacDonald Lake Fault
Bateston Fault
South Arm
SYDNEY
LEGEND
COAL SEAM (DEFINED, APPROXIMATE)
FAULT (DEFINED, APPROXIMATE)
SYNCLINE
UNDERSEA EXTENT OF MINED COAL
Modified after MacKay, 1946
1977

Figure 1. Location map of the Sydney Coalfield, Cape Breton Island.

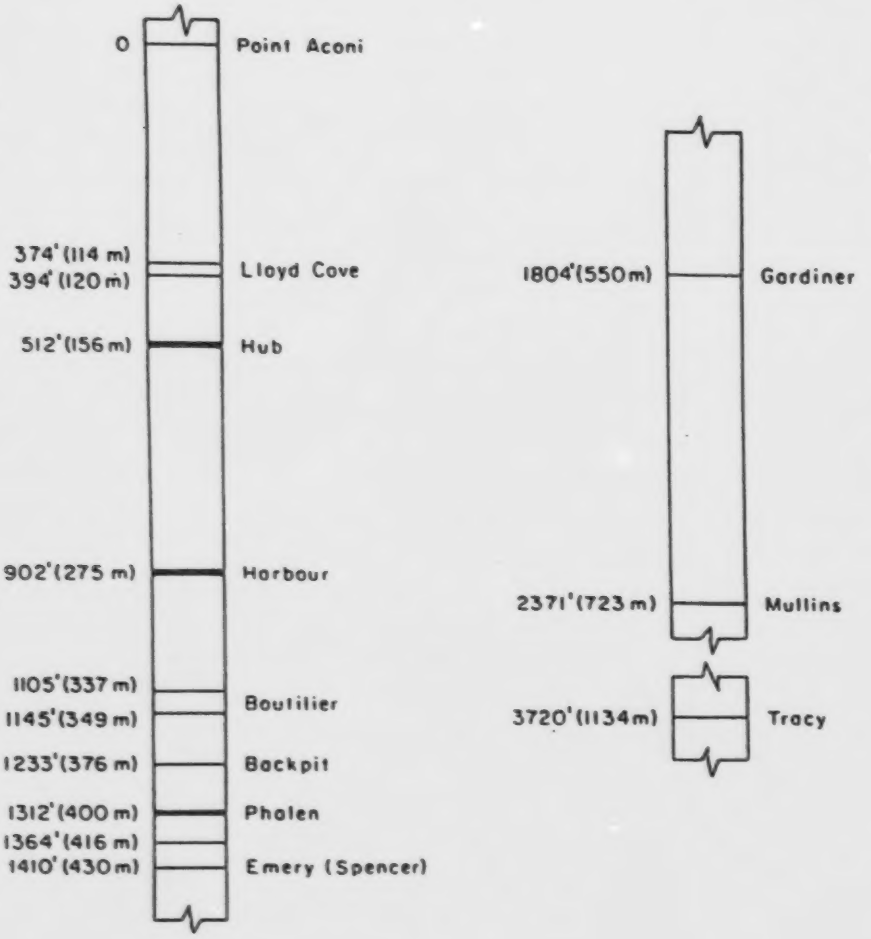

0
Point Aconi
374' (114 m)
394' (120 m)
Lloyd Cove
512' (156 m)
Hub
902' (275 m)
Harbour
1105' (337 m)
1145' (349 m)
Boutilier
1233' (376 m)
Backpit
1312' (400 m)
Phalen
1364' (416 m)
1410' (430 m)
Emery (Spencer)
1804' (550m)
Gardiner
2371' (723 m)
Mullins
3720' (1134m)
Tracy

FIGURE 2 Idealized stratigraphic column of the Sydney coalfield showing major coal seams.

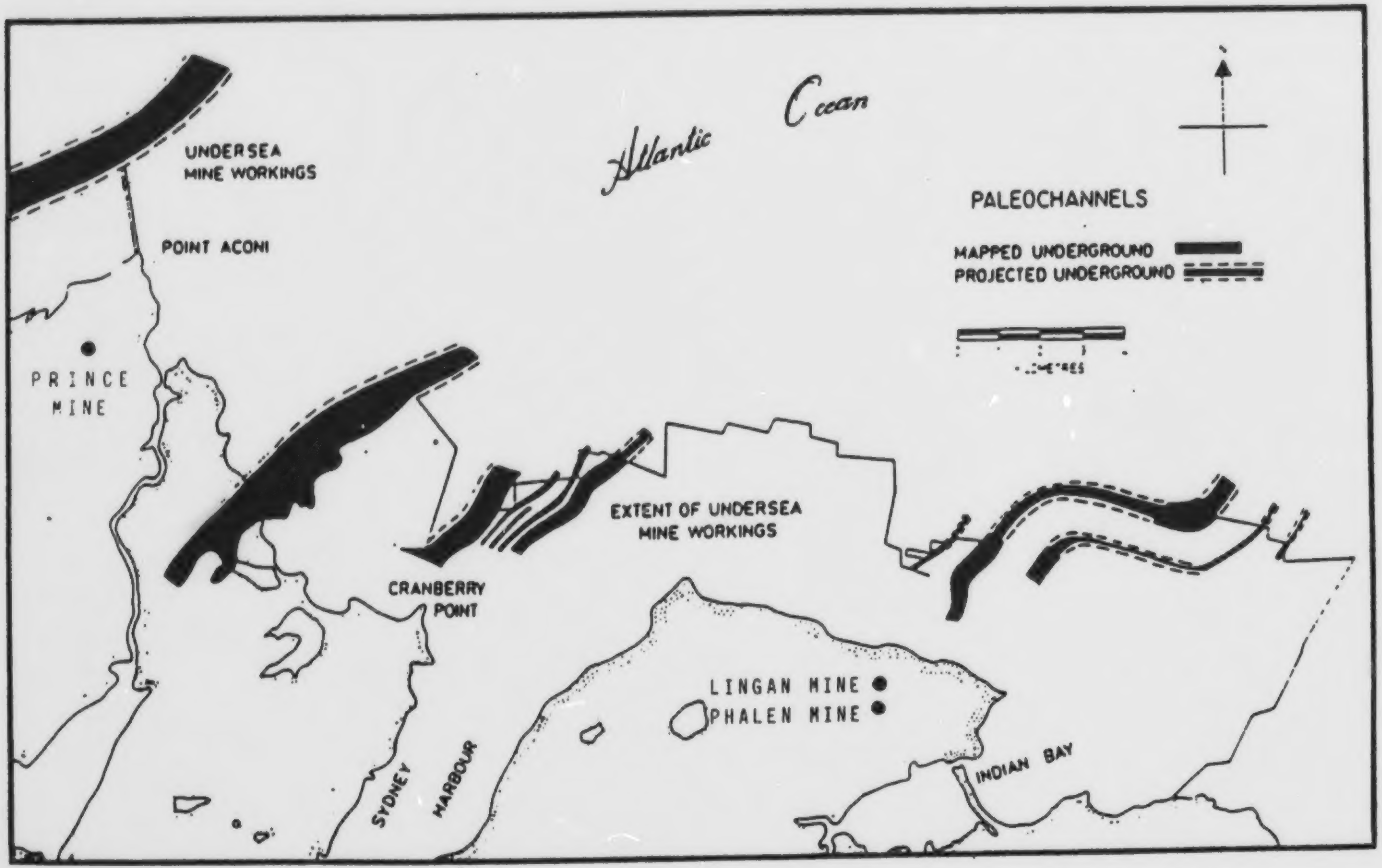
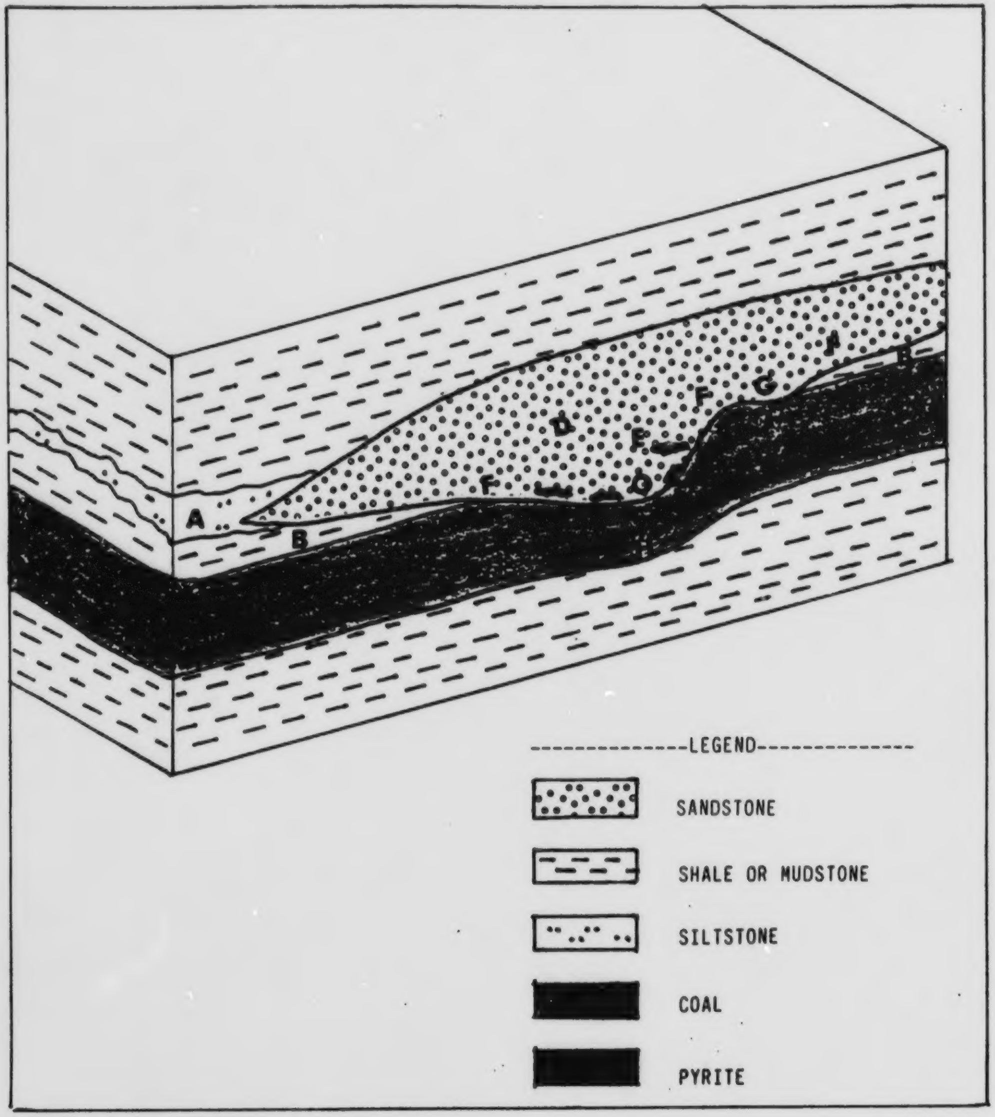

UNDERSEA
MINE WORKINGS
Atlantic Ocean
PALEOCHANNELS
MAPPED UNDERGROUND
PROJECTED UNDERGROUND
POINT ACONI
PRINCE MINE
EXTENT OF UNDERSEA
MINE WORKINGS
CRANBERRY POINT
LINGAN MINE
PHALEN MINE
SYDNEY HARBOUR
INDIAN BAY

Figure 3. Subsurface distribution and orientation of paleochannels in the Sydney Basin (after Duff et al., 1982).

Figure 4. Problems associated with sandstone channels as they approach a coal seam. (after Forgeron, 1985)



(A) ROCK INTO WHICH SANDSTONE PINCHES OUT (BECAUSE OF DISRUPTION DUE TO DIFFERENTIAL COMPACTION) IS WEAK. ROCK TENDS TO FALL. FALLS IN EXCESS OF 5ft. HIGH ARE COMMON.

(B) BECAUSE OF THE LOW ADHERANCE STRENGTH ALONG THE CONTACT BETWEEN SANDSTONE AND SHALE OR MUDSTONE, ROOF ROCK ABOVE THE SEAM TENDS TO SPALL OFF INTO WORKINGS. FALLS GENERALLY RANGE FROM A FEW INCHES TO SEVERAL FEET ABOVE THE SEAM.

(C) BECAUSE OF THE EROSIVE ACTION OF STREAM CHANNELS THE MINABLE COAL HEIGHT CAN BE REDUCED.

(D) THE SILICIOUS NATURE OF SANDSTONE CONSTITUTES A SAFETY HAZARD DUE TO "SPARKING" WHEN STRUCK BY THE PICKS OF A SHEARING DRUM.

(E) PYRITE IS COMMON ALONG THE SANDSTONE-COAL CONTACT. THIS MINERAL ADDS TO THE INCENDIVE NATURE OF THE SANDSTONE.

(F) WATER IS COMMONLY FOUND ALONG THE COAL-SANDSTONE CONTACT. INFLUX INTO THE WORKING (USUALLY MINOR) LEADS TO SLIPPERY AND GENERALLY UNCOMFORTABLE WORKING CONDITIONS.

(G) METHANE GAS INFLOW CAN BE FOUND TO OCCUR ALONG THE SANDSTONE-COAL CONTACT.

(H) MOST SANDSTONE INTRUSIONS HAVE AN ASSOCIATED "LAG" OR STRUCTURAL SYNCLINE. CUTTING BY THE SHEARER CAN BE DIFFICULT IN THIS ZONE.

(I) THE SULPHUR CONTENT OF THE COAL TENDS TO BE HIGHER IN THE AREAS WHERE SANDSTONE LIES ON TOP OF THE COAL.

This study investigated the effect that sandstone channels have on coal quality, including mineralogic, organic, thermal and coking qualities. Seam column samples collected below a sandstone channel were compared with a corresponding column collected under a shale roof. Such a detailed investigation has not previously been conducted for the Sydney Basin.

b. Previous Work

Previous work in characterizing the coal quality and influence of sandstone channels on coal seams in the Sydney Basin is limited to the monitoring of total sulphur. Investigations carried out by the Cape Breton Development Corporation over the past ten years have shown that a two to three fold rise in total sulphur occurs in a coal seam when it is directly overlain by sandstone. A halo affect of increased sulphur values has also been observed up to 100 m on both sides of the channel sandstone.

Very little reference is given in the literature to detailed studies of coal quality as it is affected by sandstone channels. Kravits and Crelling (1981) conducted one of the few studies of this nature. They examined the effect of overbank deposition on the quality and maceral composition of the Herrin No. 6 coal of Southern Illinois. Proximate, total sulphur and maceral composition were analysed at eight locations, at varying distances from the Walshville Channel sandstone. An increase in ash and sulphur was observed westward towards the sandstone channel. Pseudovitrinite also increased with proximity to the channel, suggesting formation as a result of partial oxidation of previtrinitic materials by oxygenated flood waters moving through the peat.

Harris et. al., (1981) compared elemental concentrations in two high volatile bituminous coals of Eastern Tennessee; fresh water versus marine influenced deposition. Although this paper did not deal with sandstone channels, it did illustrate vertical variations of elemental concentrations within and between seams. Major differences were found to exist in concentrations of sulphur, iron and arsenic, with the marine coal containing much higher values.

Several papers discussed in detail, the geometry and formation of paleochannels without reference to coal quality. Guion (1987a) described paleochannels encountered in the roof of the High Hazles Coal at Gedling Colliery, Nottinghamshire and discussed the sedimentary processes responsible for their formation. He also studied the influence of paleochannels on seam thickness in the coal measures of Derbyshire, England, in a subsequent paper (1987b).

Cairncross et al., (1988) compared paleochannels in the Permian Witbank Coalfield of South Africa with recently abandoned fluvial systems flanked by extensive peat swamps in the Okavago Delta to provide insight on their formation.

Ziolkowski (1989) stressed exploration as a means of minimizing risks of encountering unexpected "geological difficulties" including sandstone channels, in longwall coal mining.

The present study will provide much information and insight into the question of the influence of sandstone channels on coal quality as such information is not readily available in the published literature.

5. SAMPLE COLLECTION

Arrangements were made with Cape Breton Development Corporation representatives to collect six column samples from three operating mines in the Sydney Basin (Figure 2). From each mine, two columns of coal samples were collected: below a sandstone roof and (for comparison) below a shale roof (away from sandstone influence (Table 1). Figures 5 to 7 illustrate specific locations of each column sample.

Hammers and chisels were used to extract 15cm plys down the thickness of the seam. Clay partings and coal/clay transition zones were sampled separately and ply thicknesses were adjusted accordingly (see Appendix IIA). The durain band in the Harbour seam was sampled independently. Roof and floor samples were also taken at the column sites. Water problems in the Lingan Mine (ACI-04) prevented the collection of the lower coal and floor rock for the column section below sandstone.

Very close control in sampling enabled detailed monitoring of chemical and physical changes both vertically within a seam and laterally, between seams in each mine.

6. SAMPLE PREPARATION AND STORAGE

Figure 8 is a flow-chart outlining the handling of individual plys from each column intersection. Each ply was spread on a bench top, and a subsample taken and weighed. The subsample was reweighed the following day to determine the air-dried moisture content of the coal. (Table II.2, Appendix IIB).

A megascopic description of each ply was recorded noting any variations in lithotype composition and visible mineralization (Appendix IIA - Stratigraphic Logs). The plys were then crushed to -1/4" and riffled into subsamples for Programme I and II. The subsamples were crushed to the required mesh size (i.e. -20, -40 and -60 mesh) for corresponding laboratory analyses (Figure 8).

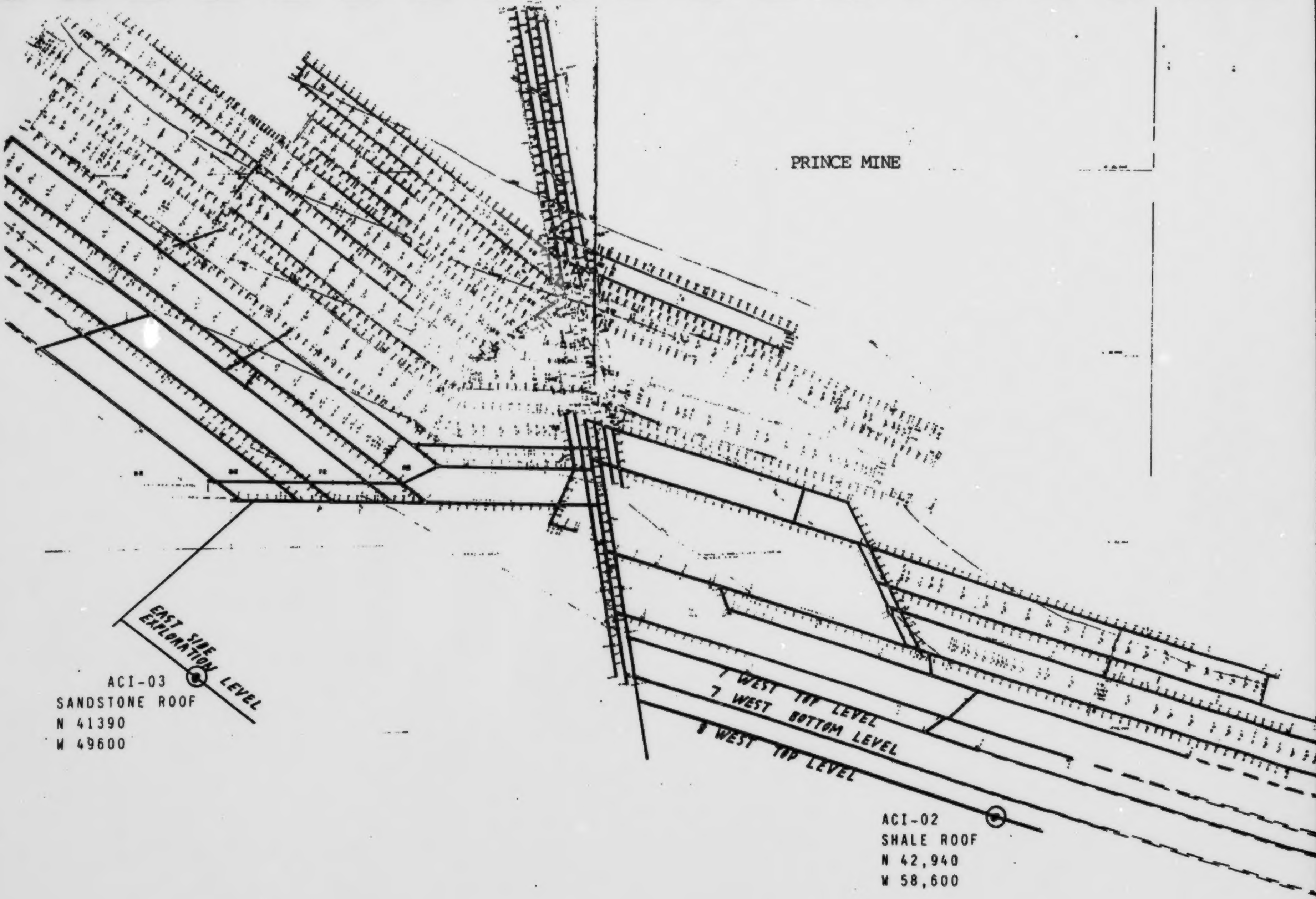

PRINCE MINE
EAST SIDE EXPLORATION LEVEL
ACI-03
SANDSTONE ROOF
N 41390
W 49600
7 WEST TOP LEVEL
7 WEST BOTTOM LEVEL
8 WEST TOP LEVEL
ACI-02
SHALE ROOF
N 42,940
W 58,600

Figure 5. Column locations from the Hub seam, Prince Mine.

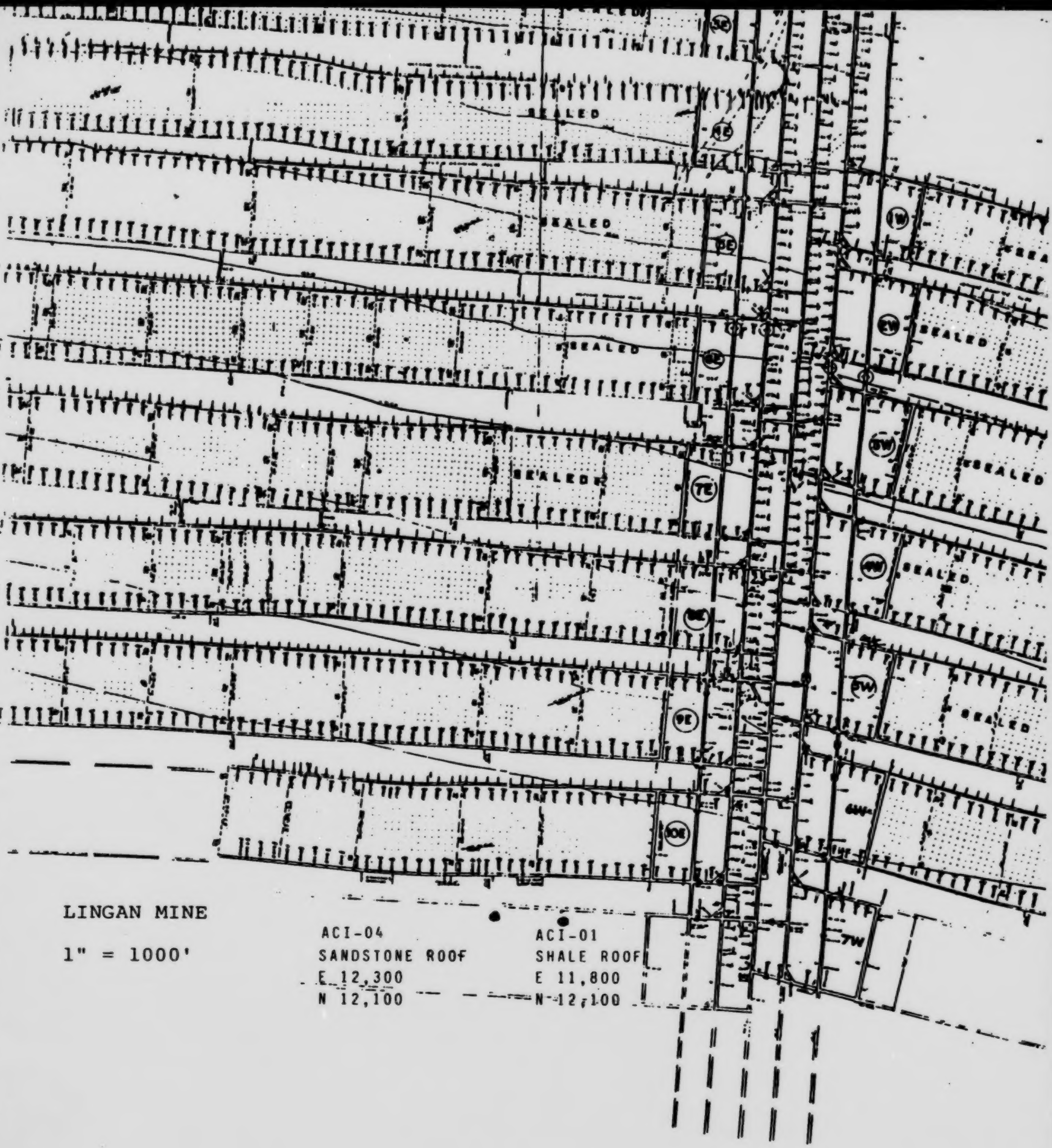

SEALED
1W
SEALED
2W
SEALED
3W
SEALED
7E
4W
SEALED
8E
5W
SEALED
9E
6W
10E
7W
LINGAN MINE
1" = 1000'
ACI-04
SANDSTONE ROOF
E 12,300
N 12,100
ACI-01
SHALE ROOF
E 11,800
N 12,100

Figure 6. Column locations from the Harbour Seam, Lingan Mine.

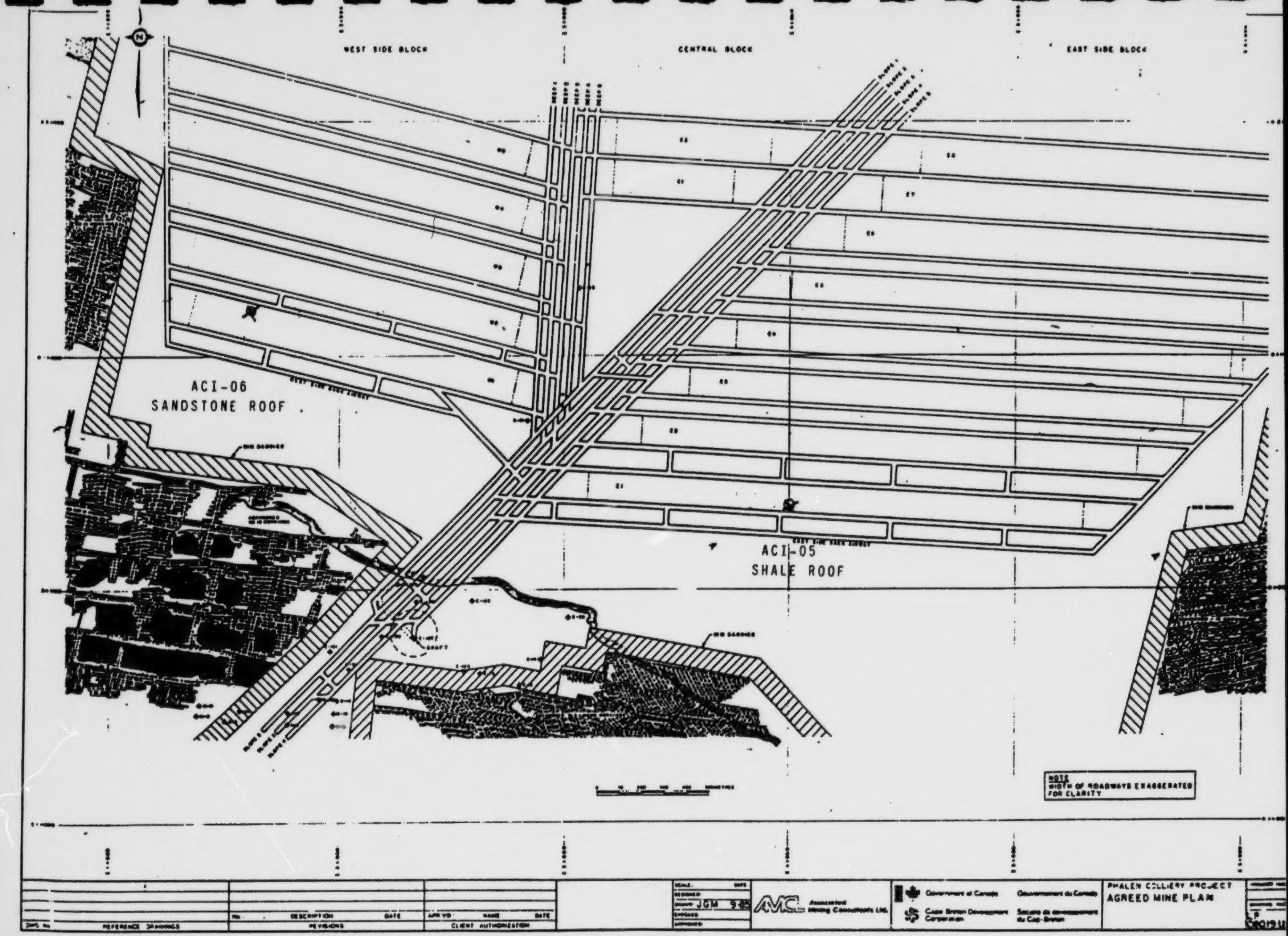
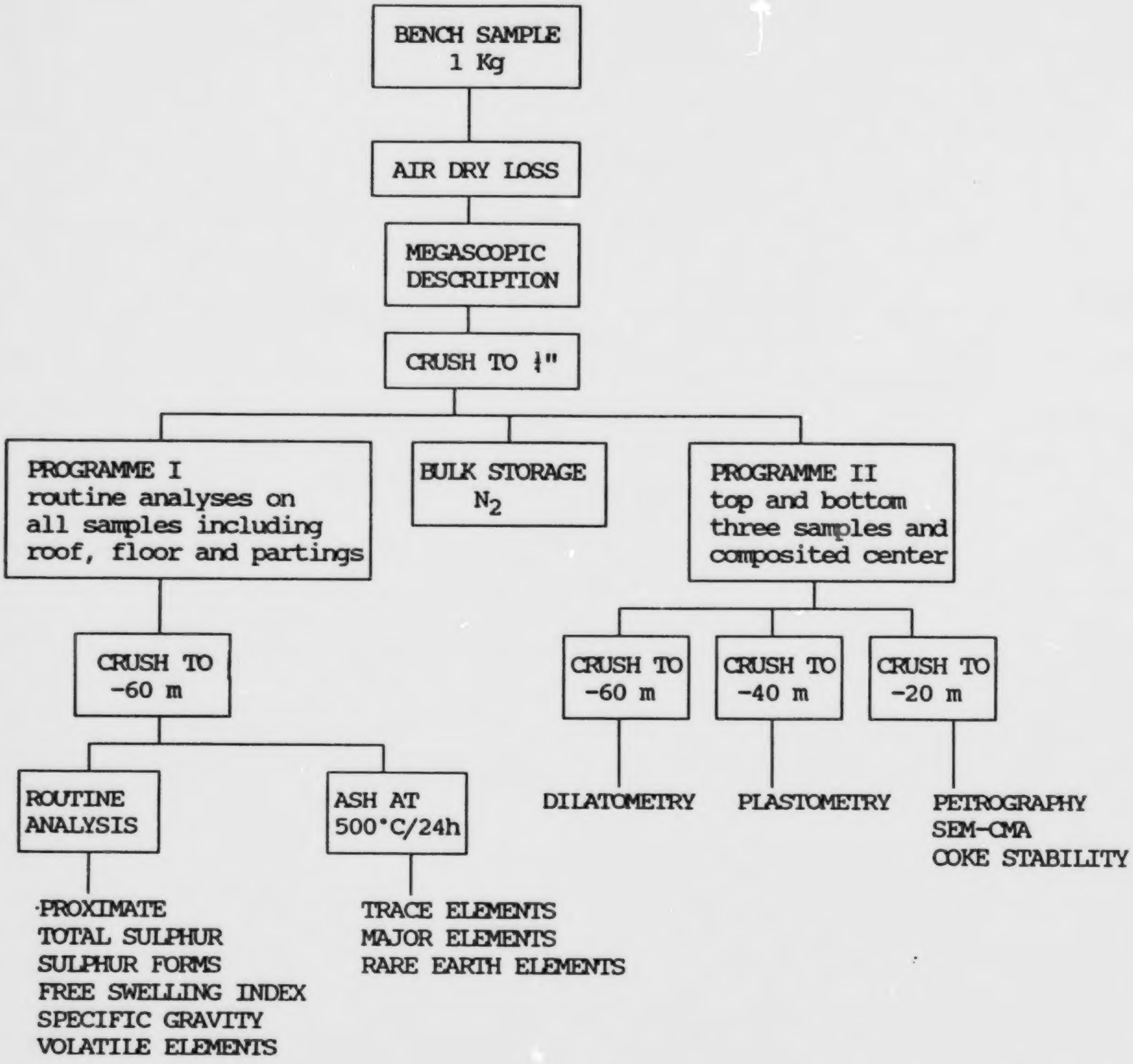

WEST SIDE BLOCK
CENTRAL BLOCK
EAST SIDE BLOCK
ACI-06
SANDSTONE ROOF
ACI-05
SHALE ROOF
NOTE
WIDTH OF ROADWAYS EXAGGERATED FOR CLARITY
JGM 9.85
Associated Mining Consultants Ltd.
Government of Canada
Gouvernement du Canada
Cape Breton Development Corporation
Société de développement du Cap-Breton
PHALEN COLLIERY PROJECT
AGREED MINE PLAN
DESCRIPTION
DATE
REVISIONS
CLIENT AUTHORIZATION
REFERENCE DRAWINGS

Figure 7. Column locations from the Phalen seam, Phalen Colliery.

Figure 8.
FLOW-CHART OF SAMPLE HANDLING


BENCH SAMPLE
1 Kg
AIR DRY LOSS
MEGASCOPIC DESCRIPTION
CRUSH TO ¼"
PROGRAMME I
routine analyses on all samples including roof, floor and partings
BULK STORAGE
N_2
PROGRAMME II
top and bottom three samples and composited center
CRUSH TO -60 m
ROUTINE ANALYSIS
PROXIMATE
TOTAL SULPHUR
SULPHUR FORMS
FREE SWELLING INDEX
SPECIFIC GRAVITY
VOLATILE ELEMENTS
ASH AT 500°C/24h
TRACE ELEMENTS
MAJOR ELEMENTS
RARE EARTH ELEMENTS
CRUSH TO -60 m
DILATOMETRY
CRUSH TO -40 m
PLASTOMETRY
CRUSH TO -20 m
PETROGRAPHY
SEM-CMA
COKE STABILITY

Composites were made for middle seam sections in Programme II by weighting the intervals according to thickness. The stratigraphic logs in Appendix IIA indicate intervals that were composited.

Any remaining sample was returned to the bulk sample bag and placed in plastic buckets for storage. For many plys, additional material was required to produce ash for trace element analyses, and this material was split and pulverized for this purpose.

TABLE 1. COLUMN SAMPLES COLLECTED FROM THE SYDNEY BASIN

MINE	SEAM	ACI ID	1988 DATE COLLECTED	ROOF ROCK	# COALS	# ROOF	# FLOOR	# PARTINGS
Prince	Hub	02	Mar 10	shale	17	1	1	0
Prince	Hub	03	Mar 15	sandstone	14	1	1	1
Lingan	Harbour	01	Mar 9	shale	13	1	1	0
Lingan	Harbour	04	May 4	sandstone	12	1	0	0
Phalen	Phalen	05	July 27	shale	18	1	1	1
Phalen	Phalen	06	Nov 1	sandstone	13	2	1	1
TOTALS					87	7	5	3

7. ANALYTICAL PROGRAMME I

a. Introduction

Programme I consisted of a detailed analytical programme on all samples collected, including roof and floor rocks as well as clay partings (where possible). Routine ASTM tests such as proximate analysis, total sulphur, sulphur forms, specific gravity and free swelling indices were conducted on each ply to characterize the variation within and among seams in the Sydney Basin.

A comprehensive major and trace element study was also conducted on individual plys to provide valuable information on the mineralogical framework of the coal seams.

Reference samples were analysed for selected tests in this programme (Appendix I) as a quality control, including international standards and a suite of unknowns submitted by CANMET.

b. Proximate Analysis

Proximate analysis determined the percent residual moisture, ash, volatile matter and fixed carbon in each sample. A Fisher Model 490 Coal Analyser was used to carry out a proximate analysis as follows. Approximately 1 gram of -60 mesh coal was weighed into a fused quartz crucible and placed in a drying oven at 107°C for one hour, cooled and reweighed. The residual moisture content was calculated from the difference in weight of the coal sample before and after drying.

The crucible and dry coal were covered with self-sealing quartz covers and placed in the Coal Analyser muffle furnace at 600°C. The sample was heated to 950°C at a rate of 35°C per minute and maintained there for seven minutes. The difference in weight between the dry coal and the residue after heating to 950°C was used to calculate the volatile matter content.

The crucible and residue was then placed in the cold muffle furnace and heated to 750°C at a rate of 35°C per minute until a constant weight was reached. The difference in weight between the dry coal and the ash product was used to calculate the ash content.

The fixed carbon content was calculated by difference using the following equation: FC (dry) = 100% - (% volatiles + % ash). The proximate analysis results are found in Table II.2, Appendix IIB.

c. Forms of Sulphur and Total Sulphur Analysis

Forms of sulphur, including pyritic, sulphate and organic sulphur were determined in accordance with ASTM method D2492-77. The sulphate sulphur was determined by extracting a weighed sample of coal with dilute hydrochloric acid and precipitating barium sulphate. Sulphates are soluble in hydrochloric acid, whereas pyritic and organic sulphur are not. Pyritic sulphur was extracted by dilute nitric acid from a weighed coal sample. This extraction involved the oxidation of the ferrous iron to ferric and the sulphide iron to sulphate, both of which are soluble in nitric acid. The extraction dissolved sulphate, pyritic sulphur, and some organic sulphur. Pyritic sulphur was calculated by determining the amount of iron in the pyritic form (FeS_2). This pyritic iron was equal to the difference between the nitric acid and hydrochloric acid soluble iron, each of which were determined by titration with potassium dichromate solution. The organic sulphur was determined by difference: % organic sulphur = % total sulphur - (% pyritic sulphur + % sulphate sulphur).

The total sulphur content was determined using a Leco Model 521 induction furnace sulphur determinator. A 0.3 gram sample of -60 mesh coal was burned in a combustion tube, and the SO_2 gas yielded in combustion was retained in a dilute HCl solution. The solution was titrated to endpoint using KIO_3 with a starch indicator. The sulphur content was calculated using the following equation:

$$\% S = \frac{A}{B} \times K$$

where: A = mls iodate (KIO_3)
B = weight of coal in grams
K = determination factor (constant)

Forms of sulphur data are found in Table II.3, Appendix IIB.

d. True Specific Gravity

The true specific gravity was determined by the bottle method in accordance with ASTM D167-73. A 10 gram sample of -60 mesh coal was placed in a 100 ml preweighed volumetric flask with some distilled water and allowed to boil for one hour with constant stirring. The flask was filled with distilled water and allowed to cool to room temperature in a water bath and reweighed. The specific gravity was determined using the following equation:

$$SG = \frac{A}{[A-(B-C)]}$$

where: A = weight in grams of dry coal
B = weight in grams of flask, dry coal, and water required
C = weight in grams of bottle and water required to fill it

True specific gravity results are found in Table II.4, Appendix IIB.

e. Free Swelling Index

The free swelling index was determined in accordance with ASTM method D720-67. A 1 gram sample of -60 mesh coal was weighed into a crucible and lowered into a furnace maintained at 820°C ± 5°C. After 2.5 minutes, the resultant coke plug was removed and compared to a profile chart to determine the amount of free swelling in the sample. The free swelling index for each of the coals analysed is found in Table II.4, Appendix II B.

f. Major Oxides, Rare Earth and Trace Element Analysis

X-ray Assay Laboratories Ltd. analysed the coal and rock intervals for major oxides, rare earth and trace elements. The samples were ashed in-house at 500°C for 24 hours, prior to shipping. The ash preparation resulted in major delays due to the low ash content of many intervals. Samples had to be resplit and pulped to obtain enough sample for analysis. Delays were also encountered when the subcontractor reported "not sufficient sample" and every attempt was made to re-ash material to complete a data set.

Major oxides were determined by X-ray Fluorescence Spectrometry (XRF) on a fused disc prepared from the sample. Major elements were calculated from oxides using conversion factors. Rare earth elements were determined by Inductively Coupled Plasma Mass Spectrometry (ICPMS) which is a state-of-the art procedure designed to provide good accuracy and precision.

Trace elements were analysed by numerous other techniques as outlined in Table II.5, Appendix IIC. Results from these multi-element analyses can be found in Tables II.6 to II.12, Appendix IIC.

Standard reference samples were also analysed and results can be found in Tables I.4 and I.5 , Appendix I.

g. Volatile Elements

X-ray Assay Laboratories Ltd. analysed the coal and rock intervals for volatile elements on a whole coal basis, without prior ashing of the samples. Chlorine (Cl), fluorine (F), and arsenic (As) were analysed by instrumental neutron activation, while mercury (Hg) was analysed by wet chemistry techniques. Analysis of fluorine was discontinued after the first set of data was reviewed due to extreme interference of the chlorine peaks resulting in numerous fluorine "less than" values.

Results from these analyses can be found in Table II.14, Appendix IIC. Standard reference samples were also analysed and results can be found in Table I.6, Appendix IA.

8. ANALYTICAL PROGRAMME II

a. Introduction

Programme II consisted of research techniques designed to characterize the organic and inorganic components of the column sections and quantify the coking properties of the coals studied. Due to budget constraints, only forty-four samples could be analysed in this programme. To optimize the information, it was decided to analyse the upper and lower three plys in each column and composite the center of the seam. The stratigraphic logs in Appendix IIA. outline the composite intervals. This decision was based on previous work (Birk and Pilgrim, 1986) suggesting that most variation in mineralogical composition is in the upper and lower sections of a coal seam.

Reference samples were analysed for selected tests in this programme (Appendix I).

b. Plastometry

The plastic properties of each coal ply and composite were measured using a Standard Instrumentation P11R constant-torque Gieseler Plastometer in accordance with the ASTM standard D2639-74. A constant torque of 40 g was applied on a stirrer placed in a crucible packed with 5.0 g of -40 mesh coal. The crucible was immersed in a molten solder bath at a temperature of 330°C. The temperature was increased by 3°C/minute to 520°C. The rates of movement of the stirrer were recorded as initial softening temperature, (maximum fluid temperature) solidification temperature (temperature when movement stops and the coal has formed coke) and the maximum fluidity (dial divisions per minute, ddpm). The results are reported in Tables III.2 to III.4, Appendix IIIA.

c. Dilatometry

The Ruhr dilatometer was used to calculate the dilation of each of the coal plys and composites. Two pencils made of -40 mesh coal were heated simultaneously under a load in a tube with a temperature increase of 30°C/minute according to specifications. Contraction and dilatation were measured as a percentage of the length of the coal pencil used. The dilatation value is a measure of the "coking ability" of the coal. In addition, the G factor or coking capacity was calculated using the following formula:

$$G = \frac{E + V}{2} \; \frac{K + D}{VK + ED}$$

where: G = G factor
K = contraction (%)
D = dilatation (%)
E = softening temperature (°C)
V = resolidification temperature (°C)

Results of these analysis are found in Tables III.6 to III.8, Appendix IIIA.

d. Coal Petrography

i) Introduction

Coal petrography is the study of organic and inorganic components of coal to characterize origin, geological history and petrophysical properties using optical microscopy (Bustin et al., 1983). Analysis of coal pellets for this study were made with a Zeiss Universal reflected light microscope equipped with a photometer and fluorescence attachments.

Microscopic analyses were completed using internationally recognized methodology and terminology (ICCP 1963, Bustin et al., 1983)

ii) Sample Preparation

Coal pellets were prepared from representative splits of coal plys and composite samples by stage crushing to -20 mesh. The coal was then mixed with transoptic powder and mounted as a 25 mm pellet in an automatic Metaserv mounting press. The resultant coal pellet underwent three grinding stages using 320, 400 and 600 grit adhesive backed grinding papers attached to Metaserv grinding laps. This was followed by two polishing stages, first with cloth and 0.3µm alumina powder suspended in distilled water, followed by double-layered silk and 0.05µm alumina powder suspended in distilled water. This procedure resulted in a fine polished surface suitable for microscopic examination of both the organic macerals and the inorganic minerals.

iii) Group Maceral Analysis

Coal is composed of a number of microscopically recognizable organic entities called macerals, each with their own distinctive properties. Three principle maceral groups in increasing order of carbon content are: exinite, vitrinite, and inertinite. These maceral groups can be subdivided into a number of macerals as illustrated in Table 2.

The point count method was used by attaching a Swift point counter and automatic stage to a Zeiss Universal petrographic microscope. Maceral determinations were made at 500x under immersion oil ($n^{25^\circ} = 1.5150$). A cross-hair graticule was used for maceral counts. Traverses were made across the pellet at 0.5 mm increments, with 0.5 mm point to point distance. A total of 500 points was counted for each coal pellet, and the volume percents were calculated and recorded in Tables III.9 to III.27, Appendix IIIB.

iv) Vitrinite Reflectance

The vitrinite reflectance or rank of the coal was determined in accordance with international methodology (I.C.C.P.). A monochromatic filter which passes light of 546 nm wavelength was mounted in the head of the microscope. Care was taken to ensure the microscope body was aligned and calibrated. A glass standard of known reflectance was used to calibrate the microscope, and this standard was measured after 25 values were recorded to ensure the stability of the system. Fifty measurements were taken on small areas of clean vitrinite for each sample. For each measurement, the stage was rotated 360°C, and the maximum reading was recorded (R_o max). Histogram plots, exhibiting the distribution, mean and standard deviation of results were plotted and can be found in Appendix IIIB. A list of measured values can also be found in Tables III.31 to III.36, Appendix IIIB.

v) Coke Stability Calculations

The coke stability of the samples was calculated from the petrographic data using the method of Schapiro et al., (1961), by determining two indices: the Balance Index (BI), and the Strength Index (SI).

TABLE 2 . MACERAL COMPONENTS (taken from Bustin et al., 1983)

Maceral Group	Maceral	Origin	Petrologic Features
Vitrinite	Telinite	woody tissues bark	exhibits cell walls
	Collinite	woody tissues	cell fillings structureless vitrinite
Liptinite	Sporinite	pollen; spores	individual bodies with distinct cell walls, high relief
	Cutinite	cuticles	serrated edges, high relief
	Resinite	resins; waxes	secondary cell filling, often zonation and internal reflections
	Alginite	algae	individual bodies or colonies
	Fusinite	woody tissues	high reflectance, colour white to yellowish, open cell walls, "bogen" structure
	Semifusinite	woody tissues	reflectance between vitrinite and fusinite, smaller cell lumina or closed, often cloudy appearance, anisotropic
	Macrinite	uncertain, probably formed through oxidation of gelified plant material	amorphous bodies of irregular shape - high reflectance
	Micrinite	secondary maceral, genesis in part related to occurrence of liptinite macerals	small size, ca 1 micron, granular appearance, high reflectance
	Sclerotinite	fungal mycelia spores	cellular structure, high reflectance
	Inertodetrinite	fragments of other inertinitic macerals	

The BI is calculated according to the formula:

$$BI = \frac{\text{total inerts (volume percent)}}{\frac{R_1}{M_1} + \frac{R_2}{M_2} + \ldots \frac{R_n}{M_n}}$$

where: $R_1, R_2 \ldots R_n$ = volume percent of reactives in V-types 1, 2 . . . n

If the coal is in balance, the amount of inerts present will be optimum for the quantity of reactives and this ratio will approach a balance index of 1.0. An excess of inerts will result in a value greater than 1.0 while a deficiency in inerts will result in a value less than 1.0.

The SI is calculated according to the formula:

$$SI = \frac{(K_1 \times P_2) + (K_2 \times P_2) + \ldots (K_n \times P_n)}{\text{total reactives (volume percent)}}$$

where: $K_1, K_2 \ldots K_n$ = strength indices of reactive V-types 1, 2 . . . n.

$P_1, P_2 \ldots P_n$ = volume percent reactives in V-types 1, 2 . . . n.

The Strength Index is defined as the comparative coke strength of the reactive macerals present in the coal mixture and is related to the rank of coal.

In this method, reactives include all the vitrinite, liptinite and one-third of the semifusinite; inerts include the remaining two-thirds semifusinite, inertinite and mineral matter. Results can be bound in Tables III.28 to III.30, Appendix IIIB.

e. Scanning Electron Microscopy

i) Introduction

For characterizing the mineralogical fraction of coals we applied scanning electron microscopy (SEM) and energy dispersive X-ray spectrometry (EDX). A JEOL T-300 scanning electron microscope and Tracor Northern TN-5500 EDX microanalyser were coupled via digital beam control to allow automated chemical and image analysis. This instrument has three detectors namely:

1. a secondary electron detector - detects low energy secondary electrons and exhibits morphology/relief of a sample.

2. a backscatter electron detector - detects high energy backscatter electrons and displays atomic number differences in a sample (i.e. the brightness is a function of the atomic number of the material).

3. an X-ray detector - detects X-rays of specific energy levels which enables chemical identification of a material.

The system was equipped with a PDP 11/23 minicomputer using a specialized Flextran software (Coal Minerals Analysis: CMA) for automated mineralogical fingerprinting and particle sizing. This system is unique in Canada and follows the technology developed by Pennsylvania State University and US Steel Research (Birk, in press).

ii) Sample Preparation and S.E.M. Operation

Coal pellets prepared for petrographic observations were coated with carbon using a fiber filament in a Polaron sputter coating unit. This placed an atomic layer of carbon on the surface of the pellet and prevented the build-up of electrons (charging) when examined. Electroconductive connections were made between the pellet and sample holder with aluminum tape.

The samples were examined under the S.E.M. with a working distance of 20 mm and an accelerating voltage of 20 Kev. A faraday cup was used to adjust the current to 1.000nA for each automated coal minerals analysis (CMA) run.

iii) Coal Minerals Analysis (CMA)

The Coal Minerals Analysis (CMA) software package is designed to classify mineral grains in coal with respect to size and chemical composition. Chemical classification is based on the relative X-ray intensities of eleven elements namely: Na, Mg, Al, Si, P, S, Cl, K, Ti, Fe, Ca. Table 3 lists the chemical classes used in the CMA program which correspond to discrete mineral phases or mineral mixtures.

Mineral particle recognition was obtained by SEM using backscatter image mode (BEI). A background threshold was set by adjusting the brightness control. Thus, a particle was recognized and characterized if its backscatter electron signal was brighter than the threshold brightness level. Three magnifications were used for analysis to cover the full particle range: 50x, 150x and 500x. Two-hundred particles, or at least twenty SEM fields of view, were analysed at each magnification.

Computer outputs of each analysis are found in Appendix IIIC (Raw Data), including information on size distribution, weight distribution and average composition of mineralogical data. Seam summary tables are also located in Appendix IIIC, Tables III.37 to III.39.

TABLE 3. CMA CHEMICAL CLASSES

1. Quartz
2. Kaolinite
3. Illite
4. Chamosite
5. Montmorillonite
6. Gypsum
7. Sulphur
8. Jarosite
9. Jarosite/Pyrite
10. Pyrite
11. Halite
12. Mixed Sulphates
13. Mixed Carbonates
14. Non-Int (Highest EDX peak not monitored by computer)
15. Unknown (EDX intensities incompatable with any of the above groups)
16. Sylvite
17. Siderite
18. Calcite
19. Dolomite
20. Ankerite
21. Rutile
22. Fe Sulphate
23. Apatite
24. Organic Quartz
25. Quartz/Pyrite
26. Mixed Silicates
27. Mixed Chlorides

9. ANALYTICAL RESULTS AND DISCUSSION

a) Proximate Analysis

Proximate analysis results can be found in Table II.2, Appendix IIB. There is great variability in results both within and among seams studied. Air-dried moisture content was highest in the Hub seam (ss. roof): average" moisture content in this column was up to 6 times that of the Harbour seam (ss roof). Residual moisture was highest in the Hub seam (sh. roof); possessing 9 times the average" residual moisture of the Harbour seam (ss. roof). A very thin fusain band in the Hub seam (ss. roof; 0.45 to 0.47 m) contained 22.66% air-dried moisture due to the absorbent nature of this microlithotype.

Moisture content of the Phalen seam was intermediate between the Hub and Harbour seams. There was no relationship between moisture content and presence of sandstone channels.

Volatile matter (dry) was greater than 31% and fixed carbon (dry) less than 69%, characterizing all the coals analysed as high volatile A bituminous coal. The Hub and Harbour seams averaged approximately 37% volatile matter, whereas the Phalen seam was slightly lower at 35% volatile matter. The fusain band (Hub ss. roof) contained anomalously low volatile matter and high fixed carbon as would be expected for fusinite. Volatile matter was not influenced by sandstone channels.

Variations in ash content with depth can be found in Figures II.1 to II.3, Appendix IIB. The shale roof column is plotted alongside the sandstone roof column for each seam for comparative purposes.

Enriched ash intervals often occurred near the roof and floor of a seam, representing transitional zones in the coal. The Harbour seam is the cleanest seam, with most intervals containing less than 5% ash, sometimes as low as 1% ash. The sandstone roof column contained slightly higher ash values throughout the seam when compared with the shale roof column.

The Phalen seam (ss. roof) contained the highest ash values with large concentrations near the base of the seam, reflecting interactions of peat with overbank deposits. The shale roof column contained less average" ash content with enrichments near the mid section as well as a shale parting near the base of the seam.

The Hub seam (sh. roof) exhibited pronounced enrichments near the top and base of the seam with considerably lower values throughout the mid section. The sandstone roof column on the other hand, contained higher average" ash content with increased ash throughout the seam. A clay parting was also observed in this column, near the base of the seam.

b. Forms of Sulphur and Total Sulphur

Sulphur forms analyses can be found in Table II.3, Appendix IIB. Total sulphur values tend to mimic the trends in ash content as illustrated in Figures II.1 to II.3, Appendix IIB. Sulphur values were enriched in the top and/or base of most seams, with pyritic sulphur being the main contributor of these enrichments. Pyritic sulphur was consistently higher in sandstone influenced column sections, often doubling the value of the corresponding shale roof column.

Organic sulphur (calculated by difference) was comparable between column sections, with values generally less than 2%, and average values close to 1% organic sulphur.

The Harbour seam is an exception to this generalization. Organic sulphur in the sandstone influenced column was two times that of the shale roof column. This may be attributed to an increase in finely disseminated pyrite in the sandstone column. This fine-grained pyrite may not have been completely extracted during the sulphur forms procedure and would be calculated as "organic sulphur".

Organic sulphur cannot be removed from coal during washing procedures thus the shale roof columns of the Harbour and Phalen seams possess the greatest potential for sulphur removal with 0.56 and 0.81% average" organic sulphur.

The Harbour seam also exhibited a significant increase in sulphate sulphur in the sandstone roof column. Other seams exhibited little or no difference in the distribution of sulphate sulphur.

Table II.1 summarized average" analytical results, including sulphur forms analyses. On average, in the shale roof columns, pyritic sulphur comprises approximately two-thirds of total sulphur, organic sulphur provides the remaining one-third, with sulphate sulphur present in negligible amounts. There is a tendency for the sandstone roof columns to contain higher average ratios of pyritic sulphur (up to 78%) with corresponding lower organic sulphur rations. The Harbour seam is an exception to this, with similar ratios in both columns.

c. True Specific Gravity

True specific gravity results can be found in Table II.4, Appendix IIB. Specific gravity of the coal plys correlates positively with ash content as can be observed in Figures II.4 to II.9, Appendix IIB. One exception to this is the fusain layer in the Hub seam (ss. roof). The specific gravity in this ply is relatively high (1.56) with 6.31% ash. Fusinite is denser than other coal macerals, which would explain the higher specific gravity. Roof and floor rocks, as well as clay partings are very high, generally close to or greater than 2.00.

The specific gravity of each ply was used in the formula to calculate the average" weight percent in Programme I.

d. Major and Minor Element Concentrations

i) Introduction

Numerous studies have been conducted on major and trace elements in coal (see References - Trace Elements in Coal). Studies relating specifically to the Sydney Coalfield are referenced in "Sydney Coalfield - Minerals and Elements". Table 4 records the average abundances of elements in the earth's crust. Comparison of elemental concentrations in sedimentary rocks with average whole coal results (Table 5) revealed distinct enrichments in arsenic (As) and chlorine (Cl) in Sydney coals.

Average germanium values were enriched in most seams (up to 2 times) while a closer examination of individual plys revealed large enrichments at some coal/rock intersections (see Figures, Appendix IIC). This trend is true of many elements as will be discussed in subsequent sections. Average" lead (Pb) values were enriched in the Hub seam only.

Concentration of many elements in the coal ash (Table 6) were often greater than those in sedimentary rocks. This suggests that the ashing process concentrates these elements from the coal and their value is dependent largely on the ash content of the coal and affinity of each element for the organic phase.

Raask (1985) published a trace element compilation of international coals as given in Table 7. When compared with results from this study on the Sydney Coalfield, most elements exhibited similar or lower concentrations. One notable exception to this generalization was the element arsenic. Arsenic was greatly enriched in the Sydney Coalfield, more so in the sandstone capped than the shale capped columns. This can be attributed to high sulphur content of Sydney Basin coals and residency of As in pyrite. Arsenic is a toxic element of environmental concern and is greatly concentrated in the ash by-product.

Table 4.

Abundances of Elements in the Earth's Crust (ppm)

Element	Igneous rock	Sedimentary rock	Soil
O	464 000	518 000	490 000
Si	281 500	248 000	330 000
Al	82 300	104 500	71 300
Fe	56 300	33 300	38 000
Ca	41 500	25 300	13 700
Na	23 600	6 600	6 300
Mg	23 300	13 400	6 300
K	20 900	22 800	13 600
Ti	5 700	4 500	4 600
P	1 050	7 700	800
Mn	950	670	850
F	625	500	200
C	20–2 000	12 000	20 000
Ba	425	80	500
Sr	375	450	300
S	260	3 000	850
Zr	165	200	300
V	135	130	100
Cl	130	160	100
Cr	100	160	200
Rb	90	200	100
Ni	75	90	40
Zn	70	80	50
Ce	60	50	50
Cu	55	57	20
Y	33	30	50
La	30	40	40
Nd	28	23	—
Co	25	23	8
Sc	22	10	7
Li	20	60	30
N	20	1 000	1 000
Nb	20	20	—
Ga	15	30	30
Pb	12.5	20	10
B	10	12	10
Th	9.6	11	0.06
Pr	8.2	5	—
Sm	6	6.5	—

(from Valkovic, 1978)

Table 4. **(continued)**

Element	Igneous rock	Sedimentary rock	Soil
Gd	5.4	6.5	—
Ge	5.4	2	1
Dy	3	4.5	—
Yb	3	3	—
Hf	3	6	6
Be	2.8	3	6
Er	2.8	2.5	—
U	2.7	3.2	1
Br	2.5	6	5
Sn	2	30	10
Ta	2	3.5	—
As	1.8	6.6	5
Mo	1.5	—	2
W	1.5	—	—
Eu	1.2	1	—
Ho	1.2	1	—
Cs	1	12	5
Tb	0.9	0.9	—
I	0.5	1	5
Lu	0.5	0.7	—
Tm	0.48	0.25	—
Tl	0.45	1	—
Cd	0.2	0.3	0.5
Sb	0.2	1	—
In	0.1	0.05	—
Bi	0.1	1	—
Hg	0.08	0.4	0.01
Ag	0.07	0.9	0.1
Pd	0.01	—	—
Re	0.005	—	—
Pt	0.005	—	—
Au	0.004	—	—
Ru	0.001	—	—
Rh	0.001	—	—
Te	0.001	0.01	—
Ir	0.001	—	—
Os	0.001	—	—
Pa	1.4×10^{-6}	1.1×10^{-6}	—
Ra	9×10^{-7}	1×10^{-6}	8×10^{-7}
Ac	5.5×10^{-10}	6.8×10^{-10}	—
Po	2×10^{-10}	2.4×10^{-10}	—
Rn	4×10^{-12}	6.9×10^{-12}	—

TABLE 5 Average* major and minor elements in the Sydney Basin
Calculated to whole coal basis.

		HUB SEAM		HARBOUR SEAM		PHALEN SEAM	
GROUP	ELEMENT	Shale	Sandstone	Shale	Sandstone	Shale	Sandstone
MAJOR ELEMENTS	Si %	0.90	0.90	0.54	0.46	1.05	1.46
	Al %	0.68	0.72	0.39	0.29	0.60	0.77
	Ca %	0.13	0.11	0.11	0.06	0.69	0.44
	Mg %	0.04	0.04	0.03	0.01	0.04	0.06
	Na %	0.06	0.07	0.02	0.01	0.05	0.06
	K %	0.05	0.07	0.02	0.02	0.07	0.08
	Fe %	2.06	2.91	1.13	2.57	1.50	3.37
	Ti %	0.04	0.04	0.02	0.02	0.03	0.05
MAJOR OXIDES	SiO2 %	1.92	1.93	1.15	0.98	2.24	3.13
	Al2O3 %	1.28	1.36	0.73	0.54	1.14	1.45
	CaO %	0.18	0.16	0.16	0.08	0.97	0.62
	MgO %	0.07	0.07	0.05	0.02	0.07	0.10
	Na2O %	0.08	0.09	0.03	0.02	0.07	0.08
	K2O %	0.06	0.09	0.03	0.02	0.08	0.10
	Fe2O3 %	2.95	4.16	1.61	3.68	2.14	4.82
	TiO2 %	0.06	0.07	0.03	0.03	0.05	0.08
RARE EARTH ELEMENTS	La ppm	5.03	4.90	2.96	2.29	3.54	4.65
	Ce ppm	9.70	9.85	5.90	4.44	7.15	9.28
	Pr ppm	1.16	1.17	0.73	0.53	0.85	1.05
	Nd ppm	4.85	4.78	3.14	2.25	3.58	4.17
	Sm ppm	0.89	0.86	0.57	0.40	0.70	0.73
	Eu ppm	0.21	0.22	0.14	0.11	0.17	0.17
	Gd ppm	0.84	0.87	0.56	0.41	0.71	0.73
	Tb ppm	0.11	0.12	0.07	0.05	0.10	0.09
	Dy ppm	0.59	0.67	0.39	0.29	0.55	0.54
	Ho ppm	0.11	0.13	0.07	0.06	0.11	0.11
	Er ppm	0.29	0.33	0.19	0.15	0.29	0.28
	Tm ppm	0.04	0.04	0.03	0.02	0.04	0.04
	Yb ppm	0.26	0.31	0.16	0.12	0.25	0.25
	Lu ppm	0.04	0.04	0.02	0.02	0.03	0.03
TRACE ELEMENTS	As ppm	59.0	92.7	27.0	33.1	56.3	88.6
	B ppm	8.9	8.0	4.2	5.5	8.6	13
	Ba ppm	24.9	36.3	26.8	24.8	70.7	103
	Be ppm	1.5	2.4	1.1	1.5	1.2	2.1
	Bi ppm	0.05	0.06	0.04	0.03	0.04	0.08
	Cl ppm	3358	3572	1033	627	3640	3679
	Co ppm	3.7	2.6	1.5	1.5	1.7	3.3
	Cr ppm	7.4	6.8	4.8	2.5	6.0	9.0
	Cs ppm	0.5	0.7	0.2	0.1	0.5	0.6
	Cu ppm	13.2	12.6	8.2	6.7	7.6	11.8
	Ga ppm	2.1	2.7	1.8	2.4	2.7	4.8
	Ge ppm	3.1	1.3	1.3	3.8	5.5	4.7
	Hf ppm	0.2	0.2	0.1	0.1	0.2	0.4
	Hg ppb	2.9	4.1	1.6	2.6	2.3	1.6
	Li ppm	5.2	9.5	5.5	2.5	7.8	12
	Mn ppm	46	62	116	54	85	62
	Mo ppm	3.6	4.3	1.6	2.0	7.2	10
	Ni ppm	15	8.9	3.7	2.4	5.0	7.9
	P ppm	26	35	65	26	70	306
	Pb ppm	36	33	1	0.9	2.0	2.4
	Rb ppm	5.3	5.1	1.9	2.2	5.7	6.8
	Sb ppm	1.4	0.65	0.44	0.06	0.56	0.44
	Sc ppm	1.1	1.1	0.6	0.4	1.2	1.4
	Sn ppm	10	6.9	7.3	4.6	5.3	23
	Sr ppm	16	21	19	5.9	44	45
	Ta ppm	0.92	1.21	0.56	0.38	0.87	1.41
	Th ppm	0.96	1.6	0.64	0.87	0.75	1.8
	U ppm	0.27	0.33	0.16	0.09	0.52	0.60
	V ppm	17	16	7.9	5.5	9.6	14
	W ppm	0.4	0.6	0.3	0.3	0.2	0.4
	Y ppm	2.6	2.7	2.0	1.6	3.0	3.1
	Zn ppm	73.0	11.2	3.6	4.2	9.5	14.1
	Zr ppm	7.8	9.5	6.0	6.0	9.8	14

TABLE 6 Average* major and minor elements in the Sydney Basin
On ash as analysed.

GROUP	ELEMENT	HUB SEAM Shale	HUB SEAM Sandstone	HARBOUR SEAM Shale	HARBOUR SEAM Sandstone	PHALEN SEAM Shale	PHALEN SEAM Sandstone
MAJOR ELEMENTS	Si %	12.9	10.8	13.2	8.23	13.4	12.9
	Al %	9.69	8.68	9.53	5.15	7.73	6.72
	Ca %	1.86	1.39	2.74	1.02	8.82	3.89
	Mg %	0.56	0.51	0.74	0.27	0.53	0.51
	Na %	0.88	0.77	0.59	0.28	0.63	0.54
	K %	0.73	0.87	0.51	0.28	0.85	0.74
	Fe %	29.6	35.1	27.8	46.3	19.1	29.6
	Ti %	0.54	0.47	0.49	0.34	0.40	0.40
MAJOR OXIDES	SiO2 %	27.6	23.2	28.3	17.6	28.6	27.5
	Al2O3 %	18.3	16.4	18.0	9.7	14.6	12.7
	CaO %	2.60	1.94	3.84	1.43	12.3	5.44
	MgO %	0.93	0.84	1.23	0.44	0.88	0.84
	Na2O %	1.18	1.04	0.79	0.38	0.85	0.73
	K2O %	0.88	1.05	0.62	0.34	1.03	0.89
	Fe2O3 %	42.3	50.2	39.7	66.2	27.3	42.3
	TiO2 %	0.90	0.79	0.81	0.56	0.67	0.66
RARE EARTH ELEMENTS	La ppm	72.1	59.1	73.0	41.1	45.2	40.8
	Ce ppm	139	119	146	79.8	91.2	81.4
	Pr ppm	16.6	14.1	18.1	9.5	10.9	9.2
	Nd ppm	69.4	57.6	77.5	40.5	45.7	36.6
	Sm ppm	12.7	10.4	14.0	7.3	9.0	6.4
	Eu ppm	3.00	2.66	3.45	1.92	2.19	1.50
	Gd ppm	12.1	10.5	13.7	7.3	9.1	6.4
	Tb ppm	1.6	1.4	1.8	0.9	1.3	0.8
	Dy ppm	8.5	8.0	9.5	5.3	7.1	4.7
	Ho ppm	1.62	1.59	1.84	1.01	1.35	0.93
	Er ppm	4.2	4.0	4.6	2.6	3.7	2.5
	Tm ppm	0.6	0.5	0.6	0.3	0.5	0.3
	Yb ppm	3.7	3.7	3.9	2.2	3.2	2.2
	Lu ppm	0.52	0.51	0.53	0.33	0.43	0.29

GROUP	ELEMENT	HUB SEAM Shale	HUB SEAM Sandstone	HARBOUR SEAM Shale	HARBOUR SEAM Sandstone	PHALEN SEAM Shale	PHALEN SEAM Sandstone
TRACE ELEMENTS	As ppm	653	1302	662	615	673	783
	B ppm	250	146	179	108	135	155
	Ba ppm	330	396	603	445	1263	1661
	Be ppm	21	24	22	24	16	18
	Bi ppm	1.0	0.8	1.1	0.5	0.5	0.6
	Co ppm	34	31	37	24	21	22
	Cr ppm	103	88	88	43	70	60
	Cs ppm	5	7	4	2	5.0	4
	Cu ppm	171	157	228	112	101	106
	Ga ppm	34.6	33.0	44.3	40.1	36.9	40.7
	Ge ppm	71	16	30	48	92	29
	Hf ppm	3	3	4	1	2	3
	Hg ppb	56	83	46	42	30	18
	Li ppm	62	97	102	34	85	77
	Mn ppm	658	775	2781	960	1084	565
	Mo ppm	58	66	64	39	89	90
	Nb ppm	19	23	19	17	16	26
	Ni ppm	135	107	78	36.0	51	69
	P ppm	367	406	1563	436	917	2671
	Pb ppm	411	393	24	14	23	17
	Rb ppm	57	61	37	34	65	51
	Sb ppm	9.2	5.9	7.6	1.1	9.8	3
	Sc ppm	13	15	12	6	14	10
	Sn ppm	322	212	310	117	177	323
	Sr ppm	305	275	355	109	801	669
	Th ppm	12.4	13.4	12.1	6.2	9.5	9.9
	Tl ppm	11.6	19.8	12.1	12.7	7.8	14.4
	U ppm	3.7	3.9	3.5	1.6	5.2	3.8
	V ppm	181	181	144	89	112	112
	W ppm	9	8	14	6	4	5
	Y ppm	43	37	46	25	39	19
	Zn ppm	1137	187	97.3	65.9	127	143
	Zr ppm	139	115	144	87	106	85

Table 7 Concentration of trace elements in U.S., British and Australian coals—arithmetic mean values, ppm

Element and chemical symbol	Coals					
	U.S.		British			Australian
	(1)	(2)	(3)	(4)	(5)	(6)
< 50 ppm						
Barium (Ba)		150	125		142	< 100
Boron (B)	102	50	61			60
Fluorine (F)	61	74			114	
Manganese (Mn)	49	100	71		84	150
Phosphorus (P)	71					310
Strontium (Sr)	37	100	69			100
Titanium (Ti)	700	800	700			900
Zinc (Zn)	272	39	89	63		< 100
10–50 ppm						
Arsenic (As)	14	15	16		18	3
Cerium (Ce)	11		33			
Bromine (Br)	15		45			
Chromium (Cr)	14	15	22		34	6
Copper (Cu)	15	19	26	48		15
Lead (Pb)	35	16	23	48	38	10
Lithium (Li)		20				
Nickel (Ni)	21	15	23		28	15
Rubidium (Rb)	14		23			
Vanadium (V)	33	20	64		76	20
Zirconium (Zr)	72	30	16			100
1–10 ppm						
Antimony (Sb)	1.3	1.1	2.8		3.1	
Beryllium (Be)	1.6	2	1.4		1.8	1.5
Cadmium (Cd)	2.5	1.3	< 0.3–3.4	0.24	0.4	
Cesium (Cs)			1.9			3
Cobalt (Co)	9.6	7	9.6			4
Gallium (Ga)	3.1		6.2			
Germanium (Ge)	6.6		5.5	6.8	5.1	6
Iodine (I)	2.0		< 1–22			
Lanthanum (La)	6.9		15			10
Molybdenum (Mo)	7.5	3	< 1–4.3		< 2	1.5
Niobium (Nb)		3				
Scandium (Sc)	2.4	3	4.6			
Selenium (Se)	2.1	4.1	2.7		2.8	0.8
Thallium (Tl)			3.4			
Thorium (Th)	2.0		< 3	3.9		< 3
Uranium (U)	1.6	1.8			1.3	2
< 1 ppm						
Mercury (Hg)	0.2	0.18	< 0.2–0.7	0.20		0.10
Silver (Ag)	0.2		< 0.7			< 0.5
Tantalum (Ta)	0.15					

(1) 101 samples of chiefly Illinois bituminous coals (Ruch *et al.*, 1974).
(2) 799 samples of bituminous and sub-bituminous coals (Swanson *et al.*, 1976).
(3) 23 samples of bituminous coals (Hislop *et al.*, 1978).
(4) 231 samples of bituminous coals (Taylor, 1973).
(5) The number of samples not stated, bituminous coal (National Coal Board, reported by Lim, 1979).
(6) 452 samples of New South Wales bituminous coals (Swaine, 1977)

(From: Raask, 1985)

ii) Major Oxide Trends

Major oxide and calculated major element data are found in Tables II.6 and II.7, Appendix IIC. The oxide concentrations in ash were dependent on total ash in each ply, thus all oxides were recalculated to a whole coal basis (Table II.8). Figures II.10 to II.15, Appendix IIC contain plots illustrating vertical oxide trends in each column. Roof and floor rocks as well as partings possessed much higher values when compared to whole rock.

Iron oxide values mimicked total sulphur results very closely as illustrated in Figures of Appendix IIB. Enrichments occurred in the top~~s~~ and base of most seams with the sandstone capped columns possessing higher average" Fe_2O_3.

Silica and aluminum oxide, on the other hand, mimicked total ash results, exhibiting similar enrichments in the top and base of seams, reflecting the transitional nature of the coal here.

Calcium oxide, along with magnesium and manganese oxide were low in both sections of the Hub and Harbour seams. The Phalen seam, however, was enriched in CaO, as illustrated in Figures II.14 and II.15. This corresponds with visible calcite observed on cleat surfaces in this seam. The shale capped column contained cyclic enrichments with highs in the base, mid and top sections, while the sandstone capped column was dramatically depleted in the mid to upper sections of the column. This suggests that the sandstone body may have introduced a source of fresh water after burial and coalification, resulting in leaching of carbonates from the upper sections. This is illustrated to a much lesser degree in the Harbour seam. The top coal ply of the shale capped column contained 0.59% CaO while the corresponding sandstone column contained only 0.13% CaO. This depletion in the upper plys of the sandstone capped column is reflected in other elements and will be discussed in Section 9.f.iii.

An anomalously high P_2O_5 value was reported in the upper plys of the Harbour seam (sh. roof). Here, apatite was detected in high concentrations by the S.E.M.-C.M.A. analysis as discussed in Section 9g. High P_2O_5 values were also reported in the lower sections of the Phalen seam (sh. and ss. roof), possibly indicating the presence of fossil fish bones. Figures II.28 to II.33 plot phosphorus (ppm - whole coal) variations down each seam.

iii. Trace Element Trends

Trace element results on ash can be found in Table II.9, Appendix IIC. "Less than" values were halved in the calculation of average" values. These results were recalculated to whole coal to determine enrichment trends (Table II.10). Figures II.16 to II.42, Appendix IIC illustrate these trends. Elements such as

Ag, Au, Cd, In, Se and Ta were consistently reported as "less than" values and provided limited information. Table II.14, Appendix IIC contains results on volatile elements such as Cl, As, F and Hg.

Most elements exhibited enrichments near the top and base of the seams as illustrated by plots in Appendix IIC. There were distinct differences in element concentrations from one seam to another independent of sandstone influence. The Hub seam, mined on the western side of the coal basin exhibited high metallic element concentrations, notably in As, Pb, An, Cu, Mo, Ni and Co. The Phalen seam on the eastern side of the basin was also high in As, Cu and Mo with concentrations of Ga, Ge, Ba, Sr, P and Sn. Both Hub and Phalen seams contained high chlorine (generally >3000 ppm).

The Harbour seam, on the other hand, contained low concentrations for most elements, with localized enrichments adjacent to roof rocks. The upper ply of the shale capped column exhibited anomalously high P, Sr and Ge suggesting a relationship with these elements.

Comparison of sandstone capped versus shale capped sections suggest similar or reduced element concentrations under the sandstone roof. This decrease is pronounced where corresponding upper plys of shale roof columns show anomalously high values, suggesting a leaching effect. Further work is necessary to test this hypothesis.

iv) Rare Earth Element Trends

Rare earth element data can be found in Tables II.11 (in ash) and Table II.12 (in coal). High total rare earth elements tended to correlate well with high Al_2O_3 content, suggesting these elements are associated with the clay fraction of the coal.

Average" rare earth-chondrite values were calculated in Table II.13 and plotted in Figures II.43 and II.44, Appendix IIC. All seams exhibited a negative Eu anomaly characteristic derived from weathering ofsilicic to intermediate basement rocks.

The Hub seam exhibited the highest values in whole coal, suggesting the greatest clay influence. The Harbour seam, on the other hand, possessed the lowest values, indicating the cleanest coal. The Phalen seam was intermediate between the two.

There appears to be little or no difference in distribution of rare earth elements between the sandstone and shale capped columns indicating that clastic deposition controls the pattern with no subsequent remobilization.

e. Rheologic Properties

i) Free Swelling Index (F.S.I.)

Free swelling index results for each ply are found in Table II.4, Appendix IIB. This simple test provides some measure of relative coking characteristics but should be used with caution in evaluating a coal's ultimate coking performance.

The Hub seam exhibited relatively poor F.S.I. values with most results less than 6.0. The sandstone roof column possessed slightly higher swelling than the column with shale roof (5.0 vs 4.0).

The Harbour seam exhibited moderate F.S.I. values with an average for the shale roof slightly higher than the sandstone roof (7.0 vs 6.0). The base plys of the Harbour seam tended to possess greater swelling than the upper plys.

The Phalen seam (sh. roof) possessed the highest F.S.I. values of all seams analysed (average F.S.I.: 8.0). The sandstone influenced column is considerably lower with an average of 6.0. This suggests, at least in some instances, the presence of sandstone channel may lower the F.S.I. of the coal beneath it.

ii) Plastometry

Plastometry results are found in Tables III.2 to III.4, Appendix IIIA. A plastometer measures the physical changes which occur in a coal during the heating process and is used to predict how coal will behave under various process conditions.

Fluidity temperatures directly under the sandstone roof tended to be lower when compared with corresponding plys from the shale roof columns. Average temperatures between columns of the same seams were very similar (see Table III.1). The plastic temperature ranges for sandstone roof columns were wider than shale roof columns by up to 42^{o}. The sandstone roof columns also exhibited consistently higher fluidity values.

The Harbour seam possessed the highest fluidity, with values exceeding 30,000 ddpm. The Hub seam, on the other hand exhibited the lowest fluidity of the three seams with values often less than 1000 ddpm. The Phalen seam yielded variable fluidity values, generally less than 10,000 ddpm.

iii) Dilatometry

Dilatometry results are found in Tables III.6 to III.8, Appendix IIIA. A dilatometer accurately measures the swelling of a coal during the heating process and is used to characterize its coking properties. Dilatometry results correspond well with plastometry results discussed in section 9.e.ii. Softening, contraction and dilation temperatures tended to be lower directly under a sandstone roof. Average temperatures between columns in the same seam were very similar (see Table III.5.). Temperature ranges varied considerably within each column.

Dilation percentages were consistently higher in the seam sections influenced by sandstone. This corresponds with increased fluidity in these sections.

Theoretically, coals that soften well should have a contraction of approximately 32%. Most of the coals analysed fell very close to this value. Table 8 characterizes the coking ability of a coal based on its dilation. Table 9 uses this information to class the columns according to the Gray-King Assay and third digit characterization.

The Harbour seam possessed the greatest dilation by far, almost ten times that of the Hub seam. The Phalen seam possessed dilation intermediate between the Hub and Harbour.

The G-factor is a calculation that determines the coking capacity of a coal. High quality coking coals possess a G-factor between 1.05 and 1.10. The G-factor calculated for the Hub seam is below this range, whereas the G-factor for the Harbour seam is above it. The Phalen seam, on the other hand falls well within the boundaries of a high quality coking coal using this parameter.

TABLE 8. Numbers Characterizing Coking Ability

DILATION (%)	GRAY-KING ASSAY (TYPE)	CHARACTERIZATION (THIRD DIGIT)
no softening	A	0
contraction only	B - D	1
0	E - G	2
0 - 50	G_1 - G_4	3
50 - 140	G_5 - G8	4
> 140	> G_8	5

TABLE 5. Characterization of Seams from the Sydney Coalfield, Based on Dilitation.

SEAM/ ROOF ROCK	DILATATION (average %)	GRAY-KING ASSAY	CHARACTERIZATION (third digit)
Hub/sh	27	G_1-G_4	3
Hub/ss	54	G_5-G_8	4
Harbour/sh	235	>G_8	5
Harbour/ss	251	>G_8	5
Phalen/sh	89	G_5-G_8	4
Phalen/ss	125	G_5-G_8	4

f. Coal Petrography

i) Composition and Rank

Coal petrographic results are found in Appendix IIIB, including recalculation of results on a mineral matter free basis. Average composition (m.m.f.) of the shale roof column versus the sandstone roof column were quite similar (Table III.9, Appendix III B). The largest discrepancy occurred in mineral matter content. The sandstone roof column contained significantly greater visible mineral matter, especially pyrite. Enrichments of pyrite were noted in the top and base of most seams, corresponding with increased total sulphur.

Tables III.10 to III.15 contain organic petrography results of the Harbour seams, illustrating maceral and mineral variations throughout the seam. There was a prominent decrease in the vitrinite content in the upper three plys of both column sections (see Appendix IIIB). This was balanced with a corresponding increase in liptinite and inertinite (semi-inertinite and inertinite). This trend suggests possible drowning of the peat, leading to eventual seam termination. Similar trends were also observed in the Hub seam and the Phalen seam (sandstone roof only) (see Tables III.6 to III.27, Appendix IIIB).

Although the organic composition of each seam was similar, the rank or maturity varied from seam to seam. The maceral and mineral composition tables contain mean reflectance values as measured down each seam. Section ii, Appendix IIIB lists individual measurements and provides histogram plots of each ply measured.

The Hub seam possessed the lowest rank with average values of 0.76% and 0.79% maximum reflectance for shale and sandstone respectively. The Harbour and Phalen seams possessed similar maximum reflectance values around 0.95% (see Table III.9).

The sandstone column in the Harbour seam exhibited a pronounced depression of reflectance values close to the roof, suggesting possible heat loss by way of the porous sandstone, during the maturation process. The trend, however, is not obvious from the other sandstone roof columns studied.

ii) Coke Stability Calculation

The coke stability was calculated using numerous parameters, including the organic composition, ash and sulphur content, and vitrinite reflectance of each ply. As each parameter varied, the corresponding Balance and Strength Index, and ultimately the Stability Factor was affected.

The average Balance Index tended to be slightly higher in the sandstone-capped columns. This can be attributed to a higher mineral matter content which would contribute to the inert fraction. All seams possessed a low Balance Index, indicating a deficiency in inert content. This reached an extreme in the lower section of the Harbour seam (shale roof) with a Balance Index of 0.15. Blending of Sydney coals with coals of high inert content would be necessary to increase the Balance Index and improve the Stability Factor.

The Strength Index was generally greater than 3.00 for all seams with the exception of the Hub seam and the upper portion of the Harbour seam (sandstone roof). These lower values are related to the lower vitrinite reflectance measurements in these sections.

The Balance Index and Strength Index together determine the Coke Stability Factor. The calculated stability factors vary considerably within and among seams with the Phalen seam exhibiting the highest and most consistent values (approximately 40). The Harbour seam averaged approximately 30 with very low values in the lower section of the shale capped column. As discussed earlier, the Balance Index is very low here, indicating a lack of inerts.

The Hub seam possessed the lowest stability factors (approximately 20) due to lower strength indices caused by lower vitrinite reflectance values.

Average stability factors are plotted in Appendix IIIB. All seams plot in the high volatile range, lower and to the right of the range for optimum metallurgical coke.

g) Mineralogy: Scanning Electron Microscopy and Energy Dispersive X-ray Microanalysis

Summary tables of individual SEM-EDX analyses using CMA software are located in Appendix IIIC. The CMA program reports the minerals as a percentage by volume or weight of total minerals rather than as a function of whole coal. A direct comparison with bulk chemistry is difficult without further calculation using normative mineralogy. In addition, the CMA data provides statistical data on particle size distribution. The significance of two dimensional particulate size data improves with the particle count but yields poor statistics if less than 100 counts are recorded per size or mineral class bin. The present study provided an overview of mineralogy but the count rates were sufficient only for semi-quantitative data. Fully quantitative analysis would require thousands of particles analysed for each ply. This was considered beyond the present study scope.

Appendix IIIC, Section ii contains the raw output data from individual C.M.A. analyses. Here the information on the weight distribution, average composition and particle size distribution of each mineral is tabulated for each ply or ply composite.

There was noted a distinct enrichment in sulphur bearing minerals in the sandstone capped columns, supporting the evidence of a trend in total sulphur analyses. This was balanced by increased silicates and clays in the shale capped columns. Figures in Appendix IIIC illustrate these trends.

The Harbour seam (sandstone roof) contained low to moderate sulphur values but very high "pyrite" recorded in the automated mineralogical analysis. This indicates a clean coal with only minute dispersed pyritic mineral matter.

Apatite was recorded in high concentrations in the top ply of the Harbour seam (shale roof). This anomaly is confirmed by the bulk elemental data for phosphorus (as P_2O_5) from the same ply. We suggest that this horizon contains a concentration of fossil fish bones.

Carbonates (calcite, dolomite, ankerite) were high throughout the Phalen seam, correlating well with the major element enrichments. Halite and gypsum were also detected in this seam in higher than usual concentrations.

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APPENDIX I

STANDARD AND REFERENCE SAMPLES

A. Summary
  i) Appalachian A and B
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APPENDIX I A. STANDARD AND REFERENCE SAMPLES

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A. SUMMARY

i) Appalachian A and B

A request was received on July 6, 1988 from the Scientific Authority, Mr. Gary Bonnell concerning the analysis of two reference samples labelled Appalachian A and B. The following analyses were requested:

- proximate analysis
- sulphur
- calorific value
- free swelling index
- plasticity
- dilatation
- petrography

These samples were analyzed in conjunction with the present study for comparative purposes, and a summary of results is presented in Tables I.1, I.2 and I.3. Results are also presented from the Energy Research Laboratories of CANMET in Bells Corner, Ottawa.

Results from the two laboratories are very comparable for the proximate, sulphur and free swelling indices. The CANMET laboratory did not report values for calorific value and plastometry. Dilatometry temperatures were comparable although dilatation percentages differed considerably. This could be due to oxidation of the sample over time.

A detailed petrographic analysis was also completed on the two reference samples and results can be found in Table I.3. Reflectance values for each sample were slightly lower from the CANMET laboratory due to the measurement of random values (G. Bonnell, personal communication) versus maximum reflectance. Random values are determined on a vitrinite grain without stage rotation and represent a value between the maximum and minimum reflectance of the sample. Since the reflectance values are used in the calculation of petrographic indices, these values differ slightly. Considering all variables, including the subjective nature of this analysis, results from the two laboratories are very comparable.

ii) Major and Trace Element Standards

Several standards were analysed for major and trace elements including the following:

Whole coal:	NBS-1632b LECO-#501-531 In-house Phalen

Coal ash: PSOC-272
NBS-1633a

Volatile elements such as chlorine and arsenic were tested using whole coal while other elements were analysed on the ashed product. Results from these standard reference samples can be found in Tables I.4 to I.6, including analyses from previous years.

Summary tables (I.7 and I.8) were also completed to illustrate the deviation of elements from their certified values and results from previous years.

Results from NBS-1633a (National Bureau of Standards) were much more consistent with certified values when compared to the PSOC-272 (Pennsylvania State University). This reflects the quality of the standard. The PSOC-272 standard was received in bulk at no charge, whereas the NBS-1633a was purchased from the National Bureau of Standards.

Most major elements in the NBS 1633a standard were within 10% of the certified value. Elements exhibiting poor results (>20% difference) included Cd, Pb, Se, Ta, and Zn. These elements also exhibited variance when compared with other available data with the exception of Ta (fair; 10<20) and Zn (good; <10%). Elements such as Lu, Au, W and Y did not have certified values but exhibited variance when compared with other available data.

Analysis of volatile element standards (whole coal) were very comparable to the certified values as can be seen in Table I.6.

TABLE I.1 Comparison of standard reference sample routine results.

ROUTINE ANALYSIS	Atlantic Coal Institute		Energy Research Laboratory	
	Appalachian A	Appalachian B	Appalachian A	Appalachian B
PROXIMATE (%)				
Moisture	1.63	0.50	1.79	0.57
Ash (dry)	6.21	5.65	6.37	5.67
Volatiles (dry)	35.31	19.12	37.66	19.53
Fixed Carbon (dry)	58.49	75.24	55.97	74.80
SULPHUR (%)	1.02	0.77	1.03	0.62
CALORIFIC VALUE (Btu/lb sul.corr.)	13953	14730	na	na

TABLE I.2 Comparison of standard reference sample rheologic properties.

RHEOLOGICAL PROPERTIES	Atlantic Coal Institute		Energy Research Laboratory	
	Appalachian A	Appalachian B	Appalachian A	Appalachian B
DILATOMETRY				
Softening Temp. C	370	418	360	416
Contraction Temp. C	420	449	419	450
Dilatation Temp. C	455	490	450	486
Contraction (%)	32	34	32	21
Dilatation (%)	37	37	62	75
PLASTOMETRY				
Softening Temp. C	403	445	na	na
Max. Fluidity Temp. C	444	482	na	na
Solidification Temp. C	480	513	na	na
Max. Fluidity ddpm	1850	89	na	na
F.S.I.	6.5	8	6.5	8.5

TABLE I.3 Comparison of standard reference sample petrographic characteristics.

PETROGRAPHIC PROPERTIES	Atlantic Coal Institute		Energy Research Laboratory	
	Appalachian A	Appalachian B	Appalachian A	Appalachian B
VITRINITE REFLECTANCE				
Mean Ro (max) %	0.92	1.67	---	---
Mean Ro (rnd) %	---	---	0.85	1.62
V-TYPE DISTRIBUTION				
V 6			1.4	
V 7	4.0		15.4	
V 8	22.6		31.7	
V 9	29.2		21.7	
V 10	10.6			
V 15		7.9		19.5
V 16		39.3		52.5
V 17		31.4		3.0
MACERAL COMP. (vol%)				
Vitrinite	66.4	78.6	70.2	75.0
Liptinite	14.2	0.0	7.5	0.0
Reactive Semifusinite	1.9	2.8	2.5	3.8
Total Reactives	82.5	81.4	80.2	78.8
Inert Semifusinite	3.7	5.6	4.9	7.6
Fusinite	2.4	3.0	1.7	4.1
Other Inertinite	8.6	6.2	9.5	6.3
Mineral Matter	2.8	3.8	3.7	3.2
Total Inerts	17.5	18.6	19.8	21.2
PETROGRAPHIC INDICES				
Parr's Mineral Matter	3.6	3.3	3.7	3.2
Balance Index	0.59	2.24	0.70	2.36
Strength Index	3.29	7.39	3.10	7.27
Stability Factor	38	61	35	61

TABLE I.4 Pennsylvania State University standard sample - PSOC-272 comparison of results.

		PSOC-272 ASH						PSOC-272 ASH			
GROUP	ELEMENT	CERT. OF ANALYSIS	XRAL. 1985	XRAL. 1986	XRAL. 1989	GROUP	ELEMENT	CERT. OF ANALYSIS	XRAL. 1985	XRAL. 1986	XRAL. 1989
MAJOR ELEMENTS	Si %	15.24	17.2	15.0	16.3	TRACE ELEMENTS	Ag ppm	<1	1.0	<0.5	<0.5
	Al %	7.68	8.72	7.96	7.94		As ppm	*	88	81	90.0
	Ca %	3.57	3.39	1.8	3.18		Au ppb	*	61	72	*
	Mg %	0.37	0.41	0.38	0.49		B ppm	*	1100	1000	1100
	Na %	0.24	0.17	0.20	0.21		Ba ppm	<5	300	310	265
	K %	1.34	1.3	1.4	1.42		Be ppm	18	<1	26	31
	Fe %	26.01	25.8	22.7	25.5		Br ppm	*	<0.5	2.2	*
	Ti %	0.44	0.47	0.49	0.47		Cd ppm	*	<0.2	<1	<0.2
							Cl ppm	*	200	<70	*
MAJOR OXIDES	SiO_2 %	32.6	36.8	32.1	34.8		Co ppm	25	28	19	27
	Al_2O_3 %	14.5	16.5	15.0	15.0		Cr ppm	100	100	97	98
	CaO %	4.99	4.74	2.52	4.45		Cs ppm	*	6.6	5.9	*
	MgO %	0.61	0.68	0.63	0.82		Cu ppm	220	76	80	70.0
	Na_2O %	0.32	0.23	0.27	0.28		Ga ppm	12	31	23	43.0
	K_2O %	1.61	1.57	1.69	1.71		Ge ppm	*	*	*	100
	Fe_2O_3 %	37.19	36.89	32.46	36.4		Hf ppm	*	3.5	3.4	*
	TiO_2 %	0.74	0.79	0.83	0.78		Hg ppm	*	*	*	13
							I ppm	*	<10	<4.4	*
RARE EARTH ELEMENTS	La ppm	<20	36.9	35.9	34.9		In ppm	*	*	*	<1
	Ce ppm	<100	79.5	70.8	78.9		Li ppm	*	*	*	44
	Pr ppm	*	*	*	9.0		Mn ppm	260	600	290	280
	Nd ppm	*	39.0	35.7	40.6		Mo ppm	*	37	47	53
	Sm ppm	*	8.90	8.32	8.5		Nb ppm	<20	42	30	25
	Eu ppm	*	2.07	1.95	1.99		Ni ppm	55	68	48	69
	Gd ppm	*	11.5	9.2	8.4		P ppm	655	690	610	611
	Tb ppm	*	1.40	1.43	1.2		Pb ppm	80	48	30	12
	Dy ppm	*	0.8	9.2	6.4		Rb ppm	*	130	95	61
	Ho ppm	*	*	*	1.24		Sb ppm	*	440	85	420
	Er ppm	*	*	*	3.8		Sc ppm	15	19	18.2	13
	Tm ppm	*	*	*	0.5		Se ppm	*	<1.0	<1.0	<0.5
	Yb ppm	11	4.43	4.12	3.1		Sn ppm	*	*	*	8
	Lu ppm	*	0.73	0.70	0.54		Sr ppm	120	160	70	70
							Ta ppm	*	1.0	0.4	*
							Th ppm	*	13	12	*
							U ppm	<7	6.20	6.59	*
							V ppm	140	570	150	180
							W ppm	*	4	8	*
							Y ppm	50	20	20	34
							Zn ppm	690	410	300	280
							Zr ppm	150	120	140	132

---

* no analysis

TABLE I.5 National Bureau of Standards - standard reference material 1633a - Trace Elements in Fly Ash.

NBS-1633a Trace Elements in Fly Ash

GROUP	ELEMENT	CERT. OF ANALYSIS	EXXON RESEARCH	XRAL. 1986	XRAL. 1989
MAJOR ELEMENTS	Si %	22.8	22.2	21.0	22.4
	Al %	14.3	14.1	13.7	14.1
	Ca %	1.11	1.06	1.1	1.14
	Mg %	0.445	0.46	0.61	0.50
	Na %	0.17	0.17	0.16	0.18
	K %	1.88	1.83	1.9	1.88
	Fe %	9.4	9.31	9.16	9.44
	Ti %	(0.8)	0.82	0.81	0.85
MAJOR OXIDES	SiO_2 %	48.8	47.5	44.9	47.9
	Al_2O_3 %	27.0	26.6	25.9	26.7
	CaO %	1.55	1.48	1.5	1.59
	MgO %	0.74	0.76	1.01	0.83
	Na_2O %	0.23	0.23	0.22	0.24
	K_2O %	2.27	2.21	2.3	2.26
	Fe_2O_3 %	13.4	13.3	13.1	13.5
	TiO_2 %	0.00	1.37	1.35	1.41
RARE EARTH ELEMENTS	La ppm	*	*	98.0	80.9
	Ce ppm	(180)		152	172
	Pr ppm	*	*	*	19.3
	Nd ppm	*	*	74.1	83.6
	Sm ppm	*	*	14.7	14.7
	Eu ppm	(4)	*	3.52	3.79
	Gd ppm	*	*	17.3	17.0
	Tb ppm	*	*	2.49	2.5
	Dy ppm	*	*	14.6	14.5
	Ho ppm	*	*	*	2.85
	Er ppm	*	*	*	7.4
	Tm ppm	*	*	*	1.0
	Yb ppm	*	*	7.48	7.3
	Lu ppm	*	*	1.38	1.06
TRACE ELEMENTS	Ag ppm	*	*	<0.5	<0.5
	As ppm	145	162	150	*
	Au ppb	*	*	<5	<40
	B ppm	*	*	40	*
	Ba ppm	(1500)	1400	1300	1340
	Be ppm	(12)	12	14	*
	Bi ppm	*	*	*	0.9
	Br ppm	*	*	3.0	*
	Cd ppm	1.00	1.2	<1	<0.2
	Cl ppm	*	*	<30	*
	Co ppm	(46)	38	44	48
	Cr ppm	196	180	190	160
	Cs ppm	(11)	*	11.1	9
	Cu ppm	118	120	100	110
	Ga ppm	(58)	*	62	59.0
	Ge ppm	*	*	*	*
	Hf ppm	(8)	*	6.9	7
	Hg ppm	*	*	*	*
	I ppm	*	*	<2.1	*
	In ppm	*	*	*	<1
	Li ppm	*	186	*	*
	Mn ppm	179	189	190	160
	Mo ppm	(29)	30	22	29
	Nb ppm	*	*	40	30
	Ni ppm	127	119	100	120
	P ppm	*	1600	1500	1659
	Pb ppm	72.4	69	94	52
	Rb ppm	131	*	160	134
	Sb ppm	6.8	10	7.2	*
	Sc ppm	(40)	*	43.6	38
	Se ppm	10.3	10	8.1	<0.5
	Sn ppm	*	*	*	8
	Sr ppm	830	765	850	797
	Ta ppm	5.7	*	1.7	2
	Th ppm	24.7	*	24	23.0
	U ppm	10.2	*	10.7	9.8
	V ppm	297	291	290	*
	W ppm	*	*	12	3
	Y ppm	*	*	90	64
	Zn ppm	220	233	220	220
	Zr ppm	*	*	280	226

* no analysis

TABLE I.6 Comparison of standards using neutron activation on whole coal.

ELEMENT	NBS STD. 1632b KNOWN	NBS STD. 1632b ANALYSED	LECO STD. #501-531 KNOWN	LECO STD. #501-531 ANALYSED	IN-HOUSE PHALEN SEAM KNOWN	IN-HOUSE PHALEN SEAM ANALYSED
Cl ppm	1260	1250	300	370	3370	3410
As ppm	3.72	4	na	na	na	na

na not available

Table I.7 Summarv of reported values for NSB-1633a analvsed in 1989 verses certified values and other available data.

CERTIFIED DATA					OTHER AVAILABLE DATA			
Good	Fair	Poor	Unknown		Good	Fair	Poor	Unknown
Si	Mg	Cd	Ag	Ce	Si	Mg	Au	As
Al		Pb	As	Dy	Al	Na	Cd	B
Ca	Cs	Se	Au	Er	Ca		Pb	Be
Na	Cr	Ta	B	Eu	K	Co	Se	Bi
K	Ba	Zn	Be	Gd	Fe	Cr	W	Br
Fe	Hf		Bi	Ho	Ti	Cs	Y	Cl
Ti	Mn		Br	La		Mn		Ge
			Cl	Lu	Ag	Mo	Lu	Hg
Co			Ge	Nd	Ba	Nb		I
Cu			Hg	Pr	Cu	Ni		In
Ga			I	Sm	Ga	Rb		Li
Mo			In	Tb	Hf	Sc		Sb
Ni			Li	Tm	P	Ta		Sn
Rb			Nb	Yb	Sr	Zr		V
Sc			Sb		Th			
Sr			Sn		U	La		Er
Th			Y		Zn	Ce		Ho
U			W			Nd		Pr
			Y		Dy			Tm
			P		Eu			
			Zr		Gd			
					Sm			
					Tb			
					Yb			

Good = within 10% of certified Good = within 10% of other results averaged
Fair = 10 to 20% of certified Fair = 10 to 20% of other results averaged
Poor = greater than 20% of certified Poor = greater than 20% of other results averaged

Table I.8 Summarv of reported values for PSDC-272 analvsed in 1989 verses certified values and other available data.

CERTIFIED DATA					OTHER AVAILABLE DATA			
Good	Fair	Poor	Unknown		Good	Fair	Poor	Unknown
Si	Ca	Mg	As	Dy	Si	Mg	Ca	Au
Al	Na		Au	Er	Al	Na		Br
K		Ba	B	Eu	K		Ag	Cl
Fe	Sc	Be	Br	Gd	Fe	Ba	Be	Cs
Ti	Zr	Cu	Cd	Ho	Ti	Cd	Ga	Ge
		Ga	Cl	Lu		Co	Mn	Hf
Ag		Nb	Cs	Nd	As	Cu	Mo	Hg
Ce		Ni	Ge	Pr	B	Ni	Nb	I
Co		Pb	Hf	Sm	Cr	Zn	Pb	In
Cr		Sr	Hg	Tb	P		Rb	Li
Mn		V	I	Tm	Se	Gd	Sb	Sn
P		Y	In		Zr	Tb	Sc	Ta
		Zr	Li				Sr	Th
			Mo		Ce		V	U
		La	Rb		Eu		Y	W
		Yb	Sb		La			
			Se		Nd		Dy	Er
			Sn		Sm		Lu	Ho
			Ta				Yb	Pr
			Th					Tm
			U					
			W					

Good = within 10% of certified
Fair = 10 to 20% of certified
Poor = greater than 20% of certified

Good = within 10% of other results averaged
Fair = 10 to 20% of other results averaged
Poor = greater than 20% of other results averaged

APPENDIX II

ANALYTICAL PROGRAMME I

A. Stratigraphic Logs
B. ASTM Analysis
C. Major and Trace Element Analysis

NOTE: Analytical Programme I

Average compositions were calculated by weight using the following formula:

$$\text{average } " = \frac{\Sigma\ (x * t * SG)}{\Sigma\ (t * SG)}$$

where: x = analytical value
t = thickness
SG = specific gravity for each ply

This method was requested by John C. Campbell, Cape Breton Development Corporation.

APPENDIX II

A. Stratigraphic Logs

APPENDIX II A. Stratigraphic Logs

List of Seams

1. Hub Seam, Prince Mine, Shale Roof
2. Hub Seam, Prince Mine, Sandstone Roof
3. Harbour Seam, Lingan Mine, Shale Roof
4. Harbour Seam, Lingan Mine, Sandstone Roof
5. Phalen Seam, Phalen Colliery, Shale Roof
6. Phalen Seam, Phalen Colliery, Sandstone Roof

LEGEND

□ Coal

▩ transitional (>20% ash)

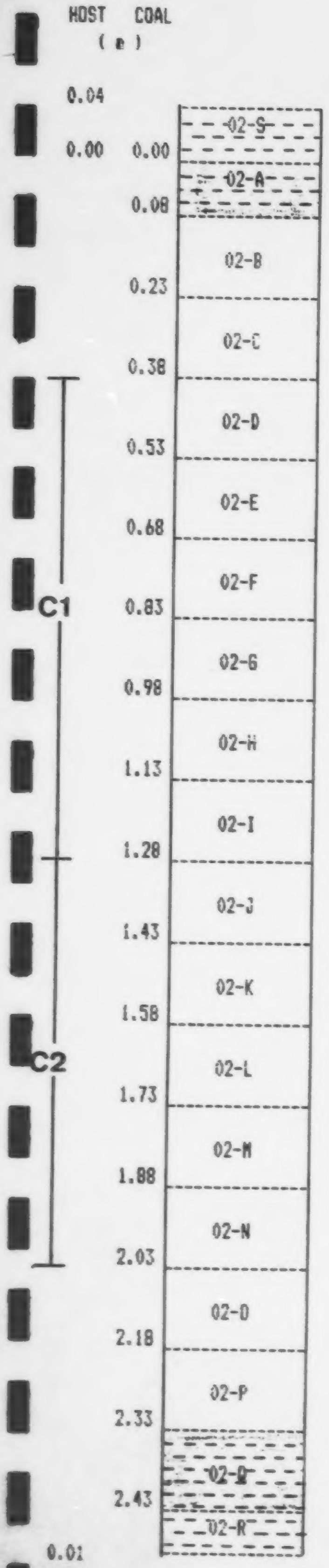
▤ clay

▦ siltstone

▒ sandstone

NOTE: Columns are not drawn to scale

1. HUB SEAM (Shale Roof) PRINCE MINE


HOST
COAL
(m)
0.04
0.00
0.00
0.08
0.23
0.38
0.53
0.68
0.83
0.98
1.13
1.28
1.43
1.58
1.73
1.88
2.03
2.18
2.33
2.43
0.01
C1
C2
02-S
02-A
02-B
02-C
02-D
02-E
02-F
02-G
02-H
02-I
02-J
02-K
02-L
02-M
02-N
02-O
02-P
02-Q
02-R

	SUL (%)	ASH (%)	DESCRIPTION
02-S	0.49	86.58	Roof rock.
02-A	10.99	28.87	Dull clarain with thin vitrain and visible pyrite.
02-B	1.38	3.38	Dull clarain with thin vitrain.
02-C	1.56	2.98	Dull coal with thin vitrain.
02-D	0.99	2.13	Dull coal with thin vitrain.
02-E	2.14	4.42	Dull coal with thin vitrain.
02-F	0.81	1.42	Thick dull bands with thin vitrain.
02-G	0.75	1.64	Thin bright banded with thin dull layers and visible pyrite.
02-H	1.05	2.49	Mixture of thick dull and thinner bright band.
02-I	2.56	4.65	Dull coal with occasional thick bright bands.
02-J	2.49	2.88	Mixture of dull and bright bands.
02-K	3.63	4.54	Mainly dull banded coal with occasional bright bands.
02-L	2.17	2.16	Mainly dull banded coal with occasional bright bands.
02-M	2.49	4.73	Dull coal with minerals.
02-N	5.69	11.84	Mainly dull banded coal with occasional bright bands.
02-O	6.55	11.19	Finely banded dull and bright coal.
02-P	6.36	15.19	Dull coal with pyrite.
02-Q	13.05	22.77	Dull coal with minerals and pyrite.
02-R	2.08	86.87	Underclay.

HUB SEAM (Sandstone Roof) PRINCE MINE

HOST (m)	COAL (m)			SUL (%)	ASH (%)	DESCRIPTION
0.03						
			03-Q	2.68	96.21	Sandstone roof rock, medium grained, porous.
0.00	0.00					
			03-A	10.44	14.09	Dull banded coal, very hard, abundant pyrite as cleat fillings, fusain bands visible.
	0.15					
			03-B	4.89	7.26	Dull coal with thin bands of vitrain, clarain, fusain; abundant visible pyrite as cleat fillings and lenses.
	0.30					
			03-C	3.64	5.47	Dull coal with banded brighter layers (mixed); abundant visible pyrite, some oxidized pyrites.
	0.45					
			03-D	1.46	6.31	Thin fusain band, very wet.
	0.47					
			03-E	3.62	15.71	Bright and dull banded coal.
	0.62					
			03-F	1.36	2.34	Bright banded coal with distinct dull layers; some pyrite visible in cleats.
	0.77					
			03-G	3.31	5.24	Mixed bright and dull banded coal; abundant visible pyrite in cleats, fusain layers also visible.
	0.92	C1				
			03-H	1.59	2.21	Mixed bright and dull banded coal; visible pyrite and fusain present
	1.07					
			03-I	1.71	2.34	Abundant thin fusain bands, dull coal with thin bright bands; some visible pyrite.
	1.22					
			03-J	2.85	3.59	Mixed bright and dull coal, some fusain; pyrite in cleats.
	1.37					
			03-K	2.65	4.78	Bright and dull banded coal, abundant fusain as thin bands.
	1.52					
			03-L	3.16	69.12	Clay parting, coaly shale; pyrite with coaly stringers.
	1.53					
			03-M	6.42	10.51	Thinly banded bright and dull coal; visible calcite?, gypsum? in cleats.
	1.68					
			03-N	6.34	12.26	Thinly banded bright and dull coal; visible calcite?, gypsum? in cleats.
	1.83					
			03-O	5.97	13.03	Abundant pyrite in cleats; thinly banded bright and dull coal; calcite/gypsum? in cleats.
0.00	1.98					
			03-P	0.35	93.25	Underclay; some carbonaceous material, rootlets visible.
0.03						

3. HARBOUR SEAM (Shale Roof) LINGAN MINE

	HOST (m)	COAL (m)	SAMPLE	SUL (%)	ASH (%)	DESCRIPTION
	0.08					
			01-N	0.95	88.09	Roof rock.
	0.00	0.00				
			01-A	4.60	11.16	Dull coal: clarain rich; with fusain bands.
		0.15				
			01-B	3.18	3.83	Bright banded coal with thin fusain bands and pyrite stringers.
		0.30				
			01-C	2.66	3.37	Bright and dull banded coal mixture.
		0.45				
C1			01-D	0.41	0.94	Thick bright bands with occasional clarian.
		0.58				
			01-O	0.31	1.99	Dull durain band with clarain and fusain.
		0.63				
			01-E	0.41	1.54	Bright and dull banded coal mixture.
		0.75				
			01-F	0.53	2.01	Thick bright bands with occasional dull bands.
		0.90				
			01-G	0.37	2.12	Thick gelified bands with thin fusain layers.
		1.05				
			01-H	1.06	9.37	Thick vitrain and fusain bands.
		1.20				
			01-I	2.34	3.47	Bright bands with finer dull bands and abundant visible pyrite.
		1.35				
			01-J	0.39	1.04	Large gelified lense and bands with thin fusain bands.
		1.50				
			01-K	1.98	3.83	Thick gelified bands mixed with thin vitrain and clarain.
		1.65				
			01-L	1.99	4.93	Thin gelified bands mixed with thin vitrain and clarain.
		1.80				
			01-M	2.32	84.33	Underclay.
	0.13					

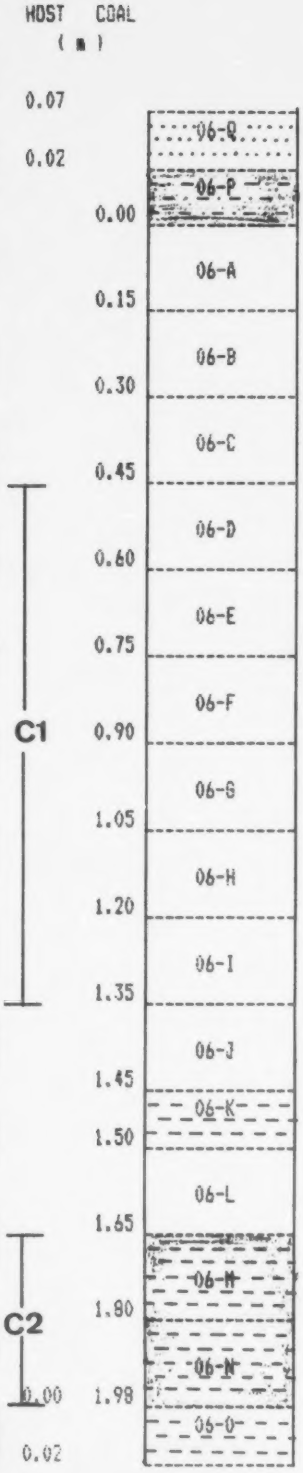
4. HARBOUR SEAM (Sandstone Roof) LINGAN MINE

	HOST	COAL		SUL	ASH	DESCRIPTION
	(m)			(%)		
	0.04					
	0.00	0.00	04-L	2.30	79.61	Sandstone roof rock, fine grained, abundant coaly laminations consisting of vitrain and fusain.
		0.15	04-A	4.27	8.80	Bright banded coal, thick vitrain layers with some fusain.
		0.30	04-B	4.10	4.99	Bright banded coal, with some fusain.
		0.45	04-C	5.17	5.39	Mixture of bright and dull banded coal, some fusain visible.
C1		0.55	04-D	3.25	4.16	Mixture of bright and dull banded coal, some fusain visible.
C1		0.60	04-M	4.66	6.84	Dull durain band, continuous.
C1		0.75	04-E	3.51	4.28	Finely banded bright and dull coal, some fusain lenses.
C1		0.90	04-F	3.60	4.33	Bright banded coal with occasional fusain lenses, visible pyrite in cleats.
C1		1.05	04-G	2.93	3.54	Bright banded coal, with some fusain.
C1		1.20	04-H	3.98	8.88	Mixture of bright and dull banded coal.
		1.35	04-I	3.30	4.64	Mixture of bright and dull banded coal.
		1.50	04-J	2.53	3.18	Bright banded coal.
		1.65	04-K	3.54	7.69	Bright and dull banded coal with abundant visible pyrite.
		1.78	NS			Coal, sample not taken due to water problems.
			NS			Underclay, sample not taken due to water problems.

5. PHALEN SEAM (Shale Roof) PHALEN COLLIERY

	HOST	COAL		SUL	ASH	DESCRIPTION
	(m)			(%)		
	0.05					
			05-A	6.57	62.61	Roof rock, dark grey, laminated shale, some coaly stringers.
	0.00	0.00				
			05-B	2.23	4.44	Bright banded coal, some fusain lenses visible, abundant calcite in cleats.
		0.15				
			05-C	1.05	5.69	Dull coal with bright bands, fusain visible, abundant calcite in cleats.
		0.30				
			05-D	0.64	5.04	Bright banded coal, abundant calcite in cleats.
		0.45				
			05-E	0.62	5.41	Dull and bright banded coal, fusain common, calcite present as cleat fillings.
		0.60				
C1			05-F	1.59	4.03	Bright and dull banded coal, some fusain visible.
		0.75				
			05-G	0.84	7.34	Dull and bright banded coal, friable, fusain present.
		0.83				
			05-H	1.45	17.87	Durain?, compacted, waxy, high clay content.
		0.93				
			05-I	5.75	14.85	Thinly banded bright and dull coal, abundant massive pyrite.
		1.08				
			05-J	0.90	5.17	Bright banded with well developed fusain lense, pressure ellipsoid observed perpendicular to bedding.
		1.23				
			05-K	0.68	6.53	Dull coal with bright bands, fusain present.
		1.38				
C2			05-L	0.49	10.65	Bright coal with thick vitrain layers, some fusain.
		1.53				
			05-M	0.55	2.60	Bright coal with thick vitrain layers, clarain also common.
		1.68				
			05-N	0.77	1.97	Thinly banded bright and dull coal.
		1.83				
			05-O	4.43	6.21	Thinly banded bright and dull coal, abundant visible pyrite as cleat fillings.
		1.98				
			05-P	1.11	3.73	Bright and dull banded coal, well developed fusain lense.
		2.13				
			05-Q	2.31	7.04	Thick bright vitrain bands with thin dull bands; well developed fusain lense; pyrite and calcite visible on some cleat faces.
		2.28				
			05-R	3.79	6.02	Thinly banded bright and dull coal; abundant calcite and some pyrite visible on cleat faces.
		2.48				
			05-S	9.72	41.57	Stone parting, finely laminated with abundant pyrite and calcite following laminations.
		2.53				
			05-T	8.10	10.95	Bright and dull banded coal with pyrite lenses.
	0.00	2.73				
			05-U	2.32	89.86	Underclay, medium grey, dense.
	0.05					

6. PHALEN SEAM (Sandstone Roof) PHALEN COLLIERY



	SUL (%)	ASH (%)	DESCRIPTION
06-Q	0.96	95.96	Sandstone roof sampled down wall from the channel sample; light grey with dark laminations.
06-P	19.20	39.73	Coaly shale, finely laminated, abundant organic matter; pyrite visible.
06-A	5.99	14.67	Bright and dull banded coal with well developed fusain layer; pyrite visible often associated with fusain.
06-B	2.97	6.29	Dull and bright banded coal; fusain visible.
06-C	2.49	3.97	Finely banded bright and dull coal; pyrite abundant in cleats and as lenses; fusain visible.
06-D	3.15	4.11	Finely banded bright coal; some fusain visible; calcite in cleats; pressure ellipsoid observed.
06-E	1.70	2.78	Finely banded bright coal; some fusain visible; calcite in cleats; pressure ellipsoid observed.
06-F	3.14	4.19	Bright and dull banded coal; calcite and pyrite observed in cleats in cleats; pressure ellipsoid observed.
06-G	1.55	2.69	Dull and bright banded coal, fusain visible; pressure ellipsoids.
06-H	1.24	2.56	Bright coal with dull bands, fusain lenses visible, some calcite on cleat faces.
06-I	3.59	5.05	Finely banded bright and dull coal; well developed fusain lenses; abundant calcite on cleat faces.
06-J	4.78	9.30	Finely banded bright and dull coal; well developed fusain lenses with associated pyrite; abundant calcite on cleat faces.
06-K	8.52	46.92	Stone band, dense, conchoidal fracture; abrupt contact with coal.
06-L	5.12	8.27	Bright banded coal with well developed vitrain bands; pyrite lense and minor calcite in cleats.
06-M	8.93	28.27	Coal interbedded with inseperatable clay partings; calcite in cleats.
06-N	7.69	28.48	Coal interbedded with inseperatable clay partings; calcite in cleats.
06-O	1.60	92.30	Underclay, medium grey, dense, with coaly laminations and rootlets?.

APPENDIX II

B. ASTM Analyses

APPENDIX II B. ASTM ANALYSES

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TABLE II.1 Average" analytical results for seam intersections from the Sydney coalfield.

TABLE II.2 Proximate and air dried moisture results.

TABLE II.3 Sulphur forms and total sulphur analysis

TABLE II.4 Specific gravity and free swelling index

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FIGURE II.2 Harbour Seam - Lingan Mine; shale roof - sandstone roof; ash, total sulphur and pyritic sulphur

FIGURE II.3 Phalen Seam - Phalen Colliery; shale roof-sandstone roof; ash, total sulphur and pyritic sulphur

FIGURE II.4 Specific gravity vs ash - Hub seam; shale roof

FIGURE II.5 Specific gravity vs ash - Hub seam, sandstone roof

FIGURE II.6 Specific gravity vs ash - Harbour seam; shale roof

FIGURE II.7 Specific gravity vs ash - Harbour seam; sandstone roof

FIGURE II.8 Specific gravity vs ash - Phalen seam; shale roof

FIGURE II.9 Specific gravity vs ash - Phalen seam; sandstone roof

Table II.1 Average* analytical results for seam intersections from the Sydney coalfield.

ROUTINE ANALYSIS (wt.%)	HUB SEAM SHALE	HUB SEAM SANDSTONE	HARBOUR SEAM SHALE	HARBOUR SEAM SANDSTONE	PHALEN SEAM SHALE	PHALEN SEAM SANDSTONE
PROXIMATE ANALYSIS						
Moisture						
a. Air Dried	1.92	3.40	0.65	0.55	0.84	0.86
b. Residual	3.97	2.75	0.86	0.44	1.85	1.63
Volatile Matter (d.b.)	36.98	36.94	36.65	37.97	35.20	34.87
Ash (d.b.)	6.98	8.30	4.05	5.56	7.84	11.40
Fixed Carbon (d.b.)	56.03	54.75	59.31	56.46	56.96	53.74
SPECIFIC GRAVITY	1.38	1.40	1.31	1.33	1.36	1.41
FREE SWELLING INDEX	4.0	5.0	7.0	6.0	8.0	6.0
SULPHUR FORMS (wt%)						
Total	3.60	4.28	1.68	3.65	2.48	4.33
Pyritic (% of Total)	2.39 (66.4)	3.03 (70.8)	1.12 (66.7)	2.40 (65.8)	1.64 (66.1)	3.38 (78.1)
Sulphate (% of Total)	0.06 (1.67)	0.06 (1.40)	0.00 (0.00)	0.12 (3.29)	0.03 (1.21)	0.02 (0.46)
Organic (% of Total)	1.15 (31.9)	1.19 (27.8)	0.56 (33.3)	1.12 (30.7)	0.81 (32.7)	0.93 (21.5)

Table II.2 Proximate and air dried moisture results.

SEAM/MINE	INTERVAL	AIR DRIED MOISTURE	RESIDUAL MOISTURE (%)	VOLATILES (%)	(%) ASH	(%) FIXED CARBON
				I-----------dry basis		-----------I
Hub Seam/ Prince Mine: Shale Roof	Roof	1.58	1.51	11.22	86.58	2.20
	0.00 - 0.08	1.34	2.50	31.51	28.87	39.62
	0.08 - 0.23	1.20	4.21	39.17	3.38	57.45
	0.23 - 0.38	1.27	4.19	38.83	2.98	58.19
	0.38 - 0.53	1.59	4.61	37.97	2.13	59.91
	0.53 - 0.68	1.84	4.93	38.08	4.42	57.51
	0.68 - 0.83	1.67	4.51	36.63	1.42	61.95
	0.83 - 0.98	2.04	4.50	37.00	1.64	61.36
	0.98 - 1.13	2.89	4.43	36.66	2.49	60.85
	1.13 - 1.28	2.05	4.35	35.94	4.65	59.40
	1.28 - 1.43	1.67	4.29	38.53	2.88	58.59
	1.43 - 1.58	1.93	4.23	38.30	4.54	57.16
	1.58 - 1.73	2.44	3.66	38.48	2.16	59.36
	1.73 - 1.88	2.15	3.21	37.34	4.73	57.93
	1.88 - 2.03	1.67	3.55	35.97	11.84	52.20
	2.03 - 2.18	1.94	3.71	36.26	11.19	52.55
	2.18 - 2.33	2.66	3.17	36.57	15.19	48.24
	2.33 - 2.43	2.14	2.80	33.13	22.77	44.10
	Floor	1.79	0.72	10.80	86.87	2.33
	Average"	1.92	3.97	36.98	6.98	56.03
Hub Seam/ Prince Mine: Sandstone Roof	Roof	5.70	0.05	3.69	96.21	0.09
	0.00 - 0.15	3.05	2.03	36.80	14.09	49.11
	0.15 - 0.30	1.94	2.51	39.72	7.26	53.02
	0.30 - 0.45	2.94	2.99	38.32	5.47	56.21
	0.45 - 0.47	22.66	1.08	16.83	6.31	76.86
	0.47 - 0.62	4.37	3.51	33.92	15.71	50.37
	0.62 - 0.77	2.52	3.04	37.50	2.34	60.15
	0.77 - 0.92	3.01	2.85	36.06	5.24	58.70
	0.92 - 1.07	2.60	3.02	43.34	2.21	54.45
	1.07 - 1.22	3.40	2.96	38.08	2.34	59.58
	1.22 - 1.37	3.92	2.86	38.81	3.59	57.60
	1.37 - 1.52	5.10	3.12	35.57	4.78	59.65
	Parting 0.01	2.55	1.16	16.88	69.12	14.00
	1.53 - 1.68	2.38	2.67	36.44	10.51	53.05
	1.68 - 1.83	3.83	2.51	35.55	12.26	52.20
	1.83 - 1.98	2.36	2.18	36.21	13.03	50.76
	Floor	2.14	0.39	6.76	93.25	0.00
	Average"	3.40	2.75	36.94	8.30	54.75

" Weighted average of coal excluding roof and floor rock.

Table II.2 Proximate and air dried moisture results.

SEAM/MINE	INTERVAL	AIR DRIED MOISTURE	RESIDUAL MOISTURE (%)	VOLATILES (%)	(%) ASH	(%) FIXED CARBON
				dry basis		
Harbour Seam/ Lingan Mine: Shale Roof	Roof	0.48	1.08	9.75	88.09	2.16
	0.00 - 0.15	0.35	0.52	34.64	11.16	54.19
	0.15 - 0.30	0.19	0.80	41.86	3.83	54.31
	0.30 - 0.45	0.33	0.73	36.91	3.37	59.72
	0.45 - 0.58	0.18	0.85	38.30	0.94	60.76
	0.58 - 0.63	0.30	0.85	36.63	1.99	61.38
	0.63 - 0.75	0.71	0.89	35.48	1.54	62.98
	0.75 - 0.90	0.62	0.83	35.33	2.01	62.65
	0.90 - 1.05	0.57	1.13	35.70	2.12	62.18
	1.05 - 1.20	1.54	1.01	33.32	9.37	57.31
	1.20 - 1.35	0.96	1.06	36.47	3.47	60.05
	1.35 - 1.50	1.02	0.47	36.28	1.04	62.68
	1.50 - 1.65	0.49	1.01	39.56	3.83	56.61
	1.65 - 1.80	0.90	1.03	36.03	4.93	59.03
	Floor	1.80	0.89	10.64	84.33	5.04
	Average'	0.65	0.86	36.65	4.05	59.31
Harbour Seam/ Lingan Mine: Sandstone Roof	Roof	0.21	0.24	12.32	79.61	8.07
	0.00 - 0.15	0.59	0.20	38.43	8.80	52.78
	0.15 - 0.30	0.39	0.76	39.12	4.99	55.89
	0.30 - 0.45	0.72	0.16	39.10	5.39	55.51
	0.45 - 0.55	0.29	0.59	39.06	4.16	56.77
	0.55 - 0.60	0.29	0.56	37.63	6.84	55.52
	0.60 - 0.75	0.38	0.55	38.48	4.28	57.24
	0.75 - 0.90	0.82	0.22	38.21	4.33	57.46
	0.90 - 1.05	0.50	0.28	39.21	3.54	57.24
	1.05 - 1.20	0.46	0.73	35.67	8.88	55.45
	1.20 - 1.35	0.32	0.73	38.50	4.64	56.86
	1.35 - 1.50	0.61	0.26	37.29	3.18	59.52
	1.50 - 1.65	0.99	0.36	35.34	7.69	56.96
	Average'	0.55	0.44	37.97	5.56	56.46

' Weighted average of coal excluding roof and floor rock.

Table II.2 Proximate and air dried moisture results.

SEAM/MINE	INTERVAL	AIR DRIED MOISTURE	RESIDUAL MOISTURE (%)	VOLATILES (%)	(%) ASH	(%) FIXED CARBON
				I-----------dry basis-----------I		
Phalen Seam/ Phalen Colliery: Shale Roof	Roof	0.33	1.12	18.18	62.61	19.21
	0.00 - 0.15	1.08	1.79	36.90	4.44	58.66
	0.15 - 0.30	0.60	1.73	37.37	5.69	56.93
	0.30 - 0.45	0.46	1.66	38.15	5.04	56.81
	0.45 - 0.60	0.68	1.91	35.44	5.41	59.15
	0.60 - 0.75	0.87	1.86	35.51	4.03	60.46
	0.75 - 0.83	0.96	1.83	33.75	7.34	58.91
	0.83 - 0.93	1.41	1.79	31.40	17.87	50.73
	0.93 - 1.08	0.62	1.83	32.25	14.85	52.90
	1.08 - 1.23	0.65	2.00	34.81	5.17	60.01
	1.23 - 1.38	0.77	1.82	34.98	6.53	58.49
	1.38 - 1.53	0.39	1.69	32.29	10.65	57.06
	1.53 - 1.68	0.64	2.20	34.88	2.60	62.51
	1.68 - 1.83	0.94	2.10	37.79	1.97	60.24
	1.83 - 1.98	0.57	1.72	36.38	6.21	57.40
	1.98 - 2.13	1.91	2.31	36.92	3.73	59.36
	2.13 - 2.28	0.89	1.94	35.89	7.04	57.07
	2.28 - 2.48	0.94	1.87	37.63	6.02	56.34
	Parting 0.05	0.86	1.17	25.01	41.57	33.42
	2.53 - 2.73	0.93	1.61	34.82	10.95	54.22
	Floor	0.35	1.50	8.24	89.86	1.90
	Average"	0.84	1.85	35.20	7.84	56.96

" Weighted average of coal excluding roof and floor rock.

Table II.2 Proximate and air dried moisture results.

SEAM/MINE	INTERVAL	AIR DRIED MOISTURE	RESIDUAL MOISTURE (%)	VOLATILES (%)	(%) ASH	(%) FIXED CARBON
				dry basis		
Phalen Seam/		1.69	0.56	4.01	95.96	0.03
Phalen Colliery:	Roof	0.41	0.97	27.18	39.73	33.09
Sandstone Roof						
	0.00 - 0.15	0.96	1.33	33.98	14.67	51.35
	0.15 - 0.30	0.52	1.35	35.40	8.29	56.31
	0.30 - 0.45	0.50	1.66	38.63	3.97	57.40
	0.45 - 0.60	0.49	1.70	38.07	4.11	57.82
	0.60 - 0.75	0.98	1.66	40.20	2.78	57.02
	0.75 - 0.90	1.13	1.89	38.00	4.19	57.81
	0.90 - 1.05	1.62	1.92	37.21	2.69	60.10
	1.05 - 1.20	1.58	2.13	36.08	2.56	61.36
	1.20 - 1.35	1.36	1.84	35.67	5.05	59.28
	1.35 - 1.45	1.32	1.70	35.52	9.30	55.18
	Parting 0.05	0.80	1.11	22.89	46.92	30.19
	1.50 - 1.65	0.41	1.71	34.94	8.27	56.79
	1.65 - 1.80	0.30	1.40	28.50	28.27	43.23
	1.80 - 1.95	0.49	1.34	29.69	28.48	41.83
	Floor	0.89	1.83	7.70	92.30	0.00
	Average*	0.86	1.63	34.87	11.40	53.74

* Weighted average of coal excluding roof and floor rock.

Table II.3 Sulphur forms and total sulphur analysis.

SEAM/MINE	SAMPLE INTERVAL (m)	SULPHATE SULPHUR weight %	PYRITIC SULPHUR weight %	ORGANIC SULPHUR weight %	TOTAL SULPHUR weight %
Hub Seam/ Prince Mine: Sandstone Absent	Roof	0.05	0.44	0.01	0.49
	0.00 - 0.08	0.14	9.19	1.66	10.99
	0.08 - 0.23	0.01	0.47	0.89	1.38
	0.23 - 0.38	0.01	0.99	0.56	1.56
	0.38 - 0.53	0.00	0.18	0.80	0.99
	0.53 - 0.68	0.02	1.12	1.00	2.14
	0.68 - 0.83	0.00	0.10	0.71	0.81
	0.83 - 0.98	0.00	0.08	0.67	0.75
	0.98 - 1.13	0.01	0.33	0.71	1.05
	1.13 - 1.28	0.04	1.50	1.02	2.56
	1.28 - 1.43	0.05	1.11	1.33	2.49
	1.43 - 1.58	0.13	2.45	1.05	3.63
	1.58 - 1.73	0.00	0.52	1.65	2.17
	1.73 - 1.88	0.04	0.96	1.48	2.49
	1.88 - 2.03	0.15	3.71	1.83	5.69
	2.03 - 2.18	0.09	4.50	1.96	6.55
	2.18 - 2.33	0.16	4.46	1.74	6.36
	2.33 - 2.43	0.23	12.47	0.34	13.05
	Floor	0.02	1.91	0.15	2.08
	Average"	0.06	2.39	1.15	3.60
Hub Seam/ Prince Mine: Sandstone Present	Roof	0.05	2.28	0.35	2.68
	0.00 - 0.15	0.10	9.47	0.87	10.44
	0.15 - 0.30	0.07	3.46	1.35	4.89
	0.30 - 0.45	0.05	2.74	0.86	3.64
	0.45 - 0.47	0.01	1.12	0.33	1.46
	0.47 - 0.62	0.11	2.49	1.02	3.62
	0.62 - 0.77	0.01	0.57	0.79	1.36
	0.77 - 0.92	0.03	1.82	1.46	3.31
	0.92 - 1.07	0.00	0.16	1.43	1.59
	1.07 - 1.22	0.01	0.32	1.38	1.71
	1.22 - 1.37	0.04	1.34	1.47	2.85
	1.37 - 1.52	0.05	1.40	1.20	2.65
	Parting 0.01	0.01	2.69	0.47	3.16
	1.53 - 1.68	0.18	5.31	0.93	6.42
	1.68 - 1.83	0.12	4.62	1.60	6.34
	1.83 - 1.98	0.05	4.60	1.31	5.97
	Floor	0.00	0.33	0.02	0.35
	Average"	0.06	3.03	1.19	4.28

Table II.3 Sulphur forms and total sulphur analysis.

SEAM/MINE	SAMPLE INTERVAL (m)	SULPHATE SULPHUR	PYRITIC SULPHUR	ORGANIC SULPHUR	TOTAL SULPHUR
		weight %			
Harbour Seam/ Lingan Mine: Sandstone Absent	Roof	0.01	0.83	0.12	0.95
	0.00 - 0.15	0.01	3.61	0.98	4.60
	0.15 - 0.30	0.01	2.63	0.53	3.18
	0.30 - 0.45	0.00	2.01	0.65	2.66
	0.45 - 0.58	0.00	0.05	0.36	0.41
	0.58 - 0.63	0.00	0.04	0.27	0.31
	0.63 - 0.75	0.00	0.04	0.37	0.41
	0.75 - 0.90	0.00	0.05	0.48	0.53
	0.90 - 1.05	0.00	0.05	0.32	0.37
	1.05 - 1.20	0.00	0.47	0.59	1.06
	1.20 - 1.35	0.00	1.80	0.53	2.34
	1.35 - 1.50	0.00	0.03	0.36	0.39
	1.50 - 1.65	0.01	1.20	0.77	1.98
	1.65 - 1.80	0.00	1.28	0.71	1.99
	Floor	0.00	1.18	0.00	1.18
	Average"	0.00	1.12	0.56	1.68
Harbour Seam/ Lingan Mine: Sandstone Present	Roof	0.32	1.94	0.03	2.30
	0.00 - 0.15	0.01	3.12	1.14	4.27
	0.15 - 0.30	0.03	2.77	1.30	4.10
	0.30 - 0.45	0.01	4.26	0.89	5.17
	0.45 - 0.55	0.22	1.59	1.44	3.25
	0.55 - 0.60	0.08	2.98	1.60	4.66
	0.60 - 0.75	0.13	2.12	1.26	3.51
	0.75 - 0.90	0.13	2.23	0.69	3.06
	0.90 - 1.05	0.10	1.36	1.47	2.93
	1.05 - 1.20	0.24	2.70	1.04	3.98
	1.20 - 1.35	0.19	2.21	0.91	3.30
	1.35 - 1.50	0.20	1.68	0.65	2.53
	1.50 - 1.65	0.13	1.88	1.52	3.54
	Average"	0.12	2.40	1.12	3.65

Table II.3 Sulphur forms and total sulphur analysis.

SEAM/MINE	SAMPLE INTERVAL (m)	SULPHATE SULPHUR	PYRITIC SULPHUR	ORGANIC SULPHUR	TOTAL SULPHUR
		weight %			
Phalen Seam/	Roof	0.02	5.47	1.07	6.57
Phalen Colliery					
Sandstone	0.00 - 0.15	0.02	1.36	0.85	2.23
Absent	0.15 - 0.30	0.00	0.43	0.62	1.05
	0.30 - 0.45	0.01	0.05	0.58	0.64
	0.45 - 0.60	0.00	0.09	0.52	0.62
	0.60 - 0.75	0.01	1.14	0.45	1.59
	0.75 - 0.83	0.00	0.20	0.64	0.84
	0.83 - 0.93	0.00	0.93	0.52	1.45
	0.93 - 1.08	0.02	4.91	0.82	5.75
	1.08 - 1.23	0.00	0.33	0.56	0.90
	1.23 - 1.38	0.01	0.04	0.63	0.68
	1.38 - 1.53	0.00	0.02	0.47	0.49
	1.53 - 1.68	0.00	0.01	0.53	0.55
	1.68 - 1.83	0.00	0.01	0.76	0.77
	1.83 - 1.98	0.00	3.42	1.01	4.43
	1.98 - 2.13	0.01	0.19	0.91	1.11
	2.13 - 2.28	0.00	1.24	1.06	2.31
	2.28 - 2.48	0.01	2.01	1.77	3.79
	2.48 - 2.53	0.20	8.82	0.70	9.72
	2.53 - 2.73	0.27	6.36	1.47	8.10
	Floor	0.02	2.18	0.12	2.32
	Average"	0.03	1.64	0.81	2.48

Table II.3 Sulphur forms and total sulphur analysis.

SEAM/MINE	SAMPLE INTERVAL (m)	SULPHATE SULPHUR	PYRITIC SULPHUR	ORGANIC SULPHUR	TOTAL SULPHUR
		weight %			
Phalen Seam/		0.01	0.92	0.03	0.96
Phalen Colliery	Roof	0.05	19.15	0.00	19.20
Sandstone					
Present	0.00 - 0.15	0.03	5.94	0.02	5.99
	0.15 - 0.30	0.02	2.37	0.58	2.97
	0.30 - 0.45	0.05	1.97	0.47	2.49
	0.45 - 0.60	0.01	2.49	0.65	3.15
	0.60 - 0.75	0.00	0.86	0.83	1.70
	0.75 - 0.90	0.00	1.53	1.61	3.14
	0.90 - 1.05	0.01	0.36	1.18	1.55
	1.05 - 1.20	0.00	0.20	1.03	1.24
	1.20 - 1.35	0.00	2.14	1.45	3.59
	1.35 - 1.45	0.03	3.31	1.44	4.78
	1.45 - 1.50	0.00	7.90	0.62	8.52
	1.50 - 1.65	0.00	3.85	1.27	5.12
	1.65 - 1.80	0.05	7.97	0.91	8.93
	1.80 - 1.95	0.03	6.61	1.05	7.69
	Floor	0.02	1.58	0.00	1.60
	Average"	0.02	3.38	0.93	4.33

TABLE II.4 Specific gravity and free swelling index.

INTERVAL (m)	SPECIFIC GRAVITY	F.S.I.	INTERVAL (m)	SPECIFIC GRAVITY	F.S.I.
Hub Seam/Prince Mine					
Shale Roof			Sandstone Roof		
Roof	2.67	0.0	Roof	2.52	0.0
0.00 - 0.08	1.68	2.5	0.00 - 0.15	1.53	4.5
0.08 - 0.23	1.35	4.5	0.15 - 0.30	1.38	5.0
0.23 - 0.38	1.34	4.5	0.30 - 0.45	1.37	6.0
0.38 - 0.53	1.33	4.0	0.45 - 0.47	1.56	1.5
0.53 - 0.68	1.34	4.5	0.47 - 0.62	1.48	4.0
0.68 - 0.83	1.31	5.0	0.62 - 0.77	1.34	6.5
0.83 - 0.98	1.33	5.0	0.77 - 0.92	1.37	5.5
0.98 - 1.13	1.36	4.5	0.92 - 1.07	1.31	5.5
1.13 - 1.28	1.35	4.5	1.07 - 1.22	1.31	5.0
1.28 - 1.43	1.33	4.0	1.22 - 1.37	1.34	5.0
1.43 - 1.58	1.36	4.5	1.37 - 1.52	1.37	6.0
1.58 - 1.73	1.32	5.0			
1.73 - 1.88	1.35	4.0	Parting 0.01	2.25	0.0
1.88 - 2.03	1.45	4.5			
2.03 - 2.18	1.45	3.5	1.53 - 1.68	1.43	5.0
2.18 - 2.33	1.45	4.0	1.68 - 1.83	1.47	6.0
2.33 - 2.43	1.65	2.0	1.83 - 1.98	1.48	5.0
Floor	2.53	0.0	Floor	2.50	0.0
Average"	1.38	4.0	Average"	1.40	5.0

" Weighted average of seam excluding roof and floor rock.

TABLE II.4 Specific gravity and free swelling index.

INTERVAL (m)	SPECIFIC GRAVITY	F.S.I.	INTERVAL (m)	SPECIFIC GRAVITY	F.S.I.
Harbour Seam/Lingan Mine					
Shale Roof			Sandstone Roof		
Roof	2.55	0.0	Roof	2.35	1.0
0.00 - 0.15	1.38	5.5	0.00 - 0.15	1.35	5.5
0.15 - 0.30	1.32	6.5	0.15 - 0.30	1.30	5.0
0.30 - 0.45	1.30	5.0	0.30 - 0.45	1.34	5.0
0.45 - 0.58	1.26	6.0	0.45 - 0.55	1.29	4.5
0.58 - 0.63	1.30	5.0	0.55 - 0.60	1.38	1.5
0.63 - 0.75	1.30	7.0	0.60 - 0.75	1.31	4.5
0.75 - 0.90	1.31	8.0	0.75 - 0.90	1.32	7.0
0.90 - 1.05	1.28	8.0	0.90 - 1.05	1.30	7.0
1.05 - 1.20	1.35	7.5	1.05 - 1.20	1.38	7.0
1.20 - 1.35	1.33	8.0	1.20 - 1.35	1.34	7.0
1.35 - 1.50	1.30	8.0	1.35 - 1.50	1.31	8.0
1.50 - 1.65	1.33	8.0	1.50 - 1.65	1.37	8.5
1.65 - 1.80	1.31	8.0			
Floor	2.40	0.0			
Average"	1.31	7.0	Average"	1.33	6.0

" Weighted average of seam excluding roof and floor rock.

TABLE II.4 Specific gravity and free swelling index.

INTERVAL (m)	SPECIFIC GRAVITY	F.S.I.	INTERVAL (m)	SPECIFIC GRAVITY	F.S.I.
Phalen Seam/Phalen Colliery					
Shale Roof			Sandstone Roof		
				2.75	1.0
Roof	2.07	1.0	Roof	1.98	4.0
0.00 - 0.15	1.35	8.0	0.00 - 0.15	1.47	6.5
0.15 - 0.30	1.33	8.5	0.15 - 0.30	1.37	7.5
0.30 - 0.45	1.33	8.0	0.30 - 0.45	1.34	7.5
0.45 - 0.60	1.31	8.5	0.45 - 0.60	1.34	7.5
0.60 - 0.75	1.32	8.0	0.60 - 0.75	1.31	4.5
0.75 - 0.83	1.34	8.5	0.75 - 0.90	1.35	6.5
0.83 - 0.93	1.44	8.0	0.90 - 1.05	1.31	7.5
0.93 - 1.08	1.49	8.0	1.05 - 1.20	1.30	7.5
1.08 - 1.23	1.35	8.5	1.20 - 1.35	1.34	7.0
1.23 - 1.38	1.34	8.0	1.35 - 1.45	1.40	7.5
1.38 - 1.53	1.35	7.0			
1.53 - 1.68	1.30	8.5	1.45 - 1.50	1.90	1.0
1.68 - 1.83	1.29	8.5			
1.83 - 1.98	1.35	8.5	1.50 - 1.65	1.39	7.0
1.98 - 2.13	1.30	8.0	1.65 - 1.80	1.66	3.0
2.13 - 2.28	1.34	8.5	1.80 - 1.95	1.60	3.0
2.28 - 2.48	1.34	8.0			
2.48 - 2.53	1.83	1.5	Floor	2.72	0.0
2.53 - 2.73	1.45	8.0			
Floor	2.54	0.0			
Average"	1.36	8.0	Average"	1.41	6.0

" Weighted average of seam excluding roof and floor rock.

FIGURE II.1

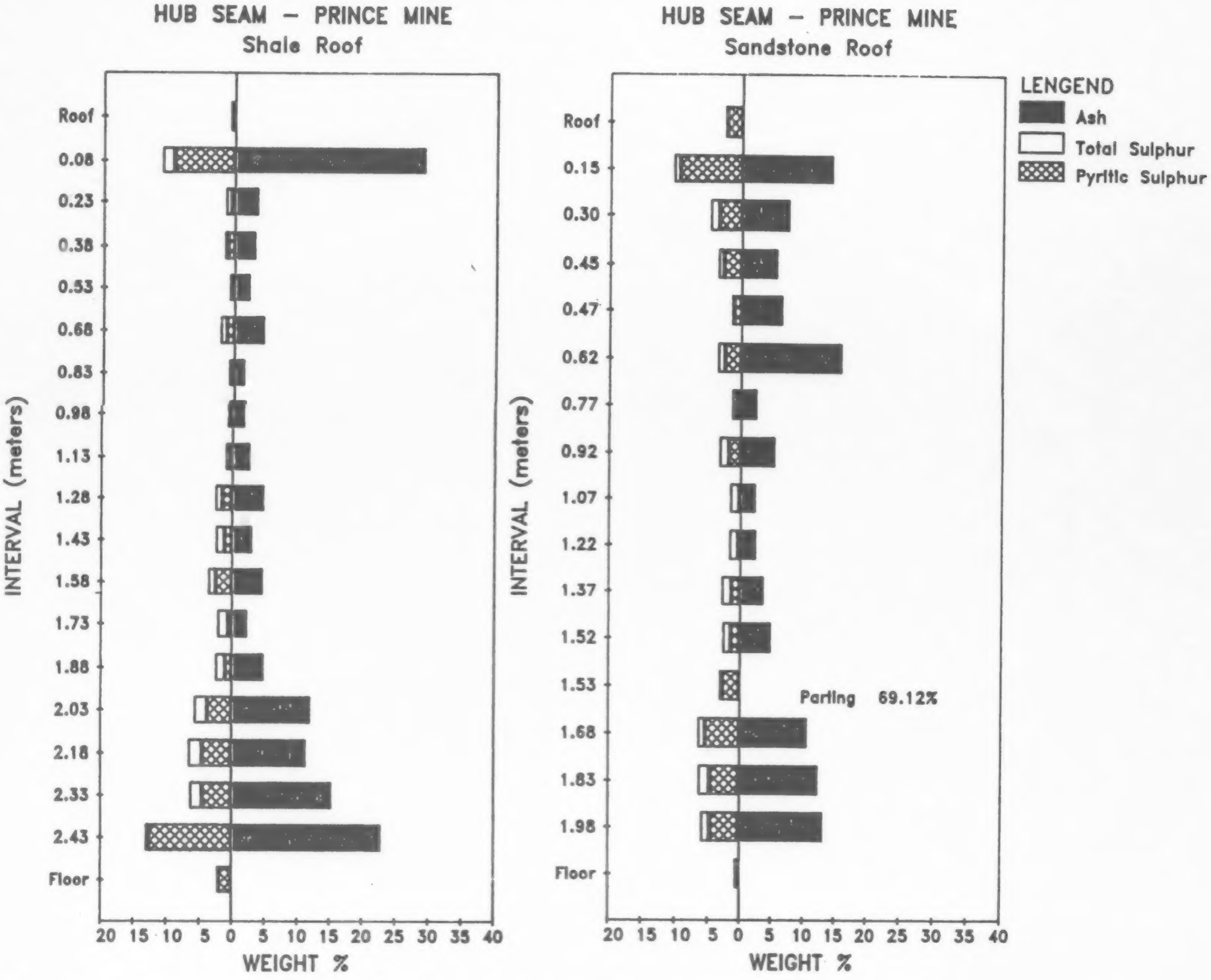
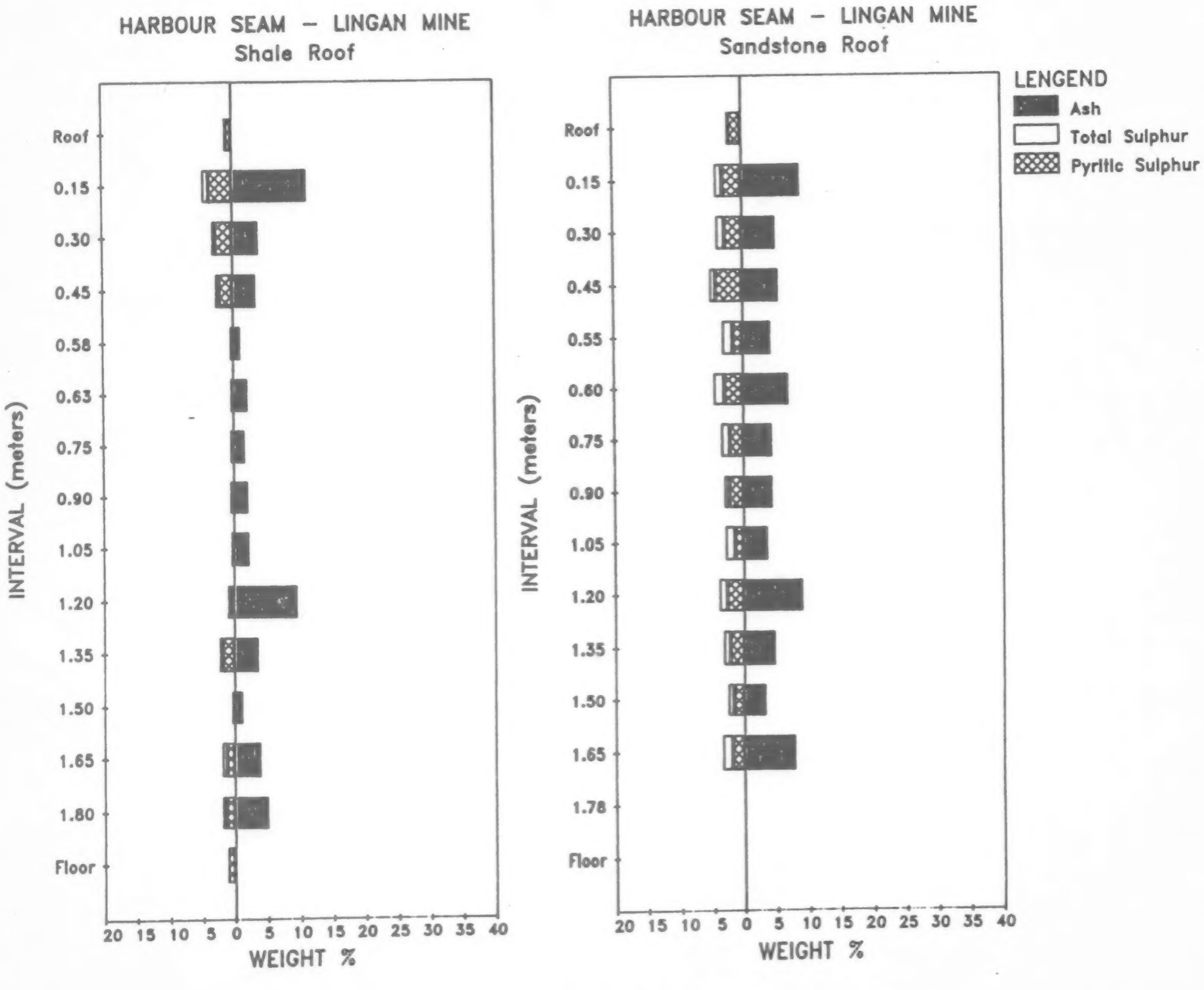

HUB SEAM – PRINCE MINE
Shale Roof
HUB SEAM – PRINCE MINE
Sandstone Roof
LENGEND
Ash
Total Sulphur
Pyritic Sulphur
INTERVAL (meters)
Roof
0.08
0.23
0.38
0.53
0.68
0.83
0.98
1.13
1.28
1.43
1.58
1.73
1.88
2.03
2.18
2.33
2.43
Floor
INTERVAL (meters)
Roof
0.15
0.30
0.45
0.47
0.62
0.77
0.92
1.07
1.22
1.37
1.52
1.53
1.68
1.83
1.98
Floor
Parting 69.12%
20 15 10 5 0 5 10 15 20 25 30 35 40
WEIGHT %
20 15 10 5 0 5 10 15 20 25 30 35 40
WEIGHT %

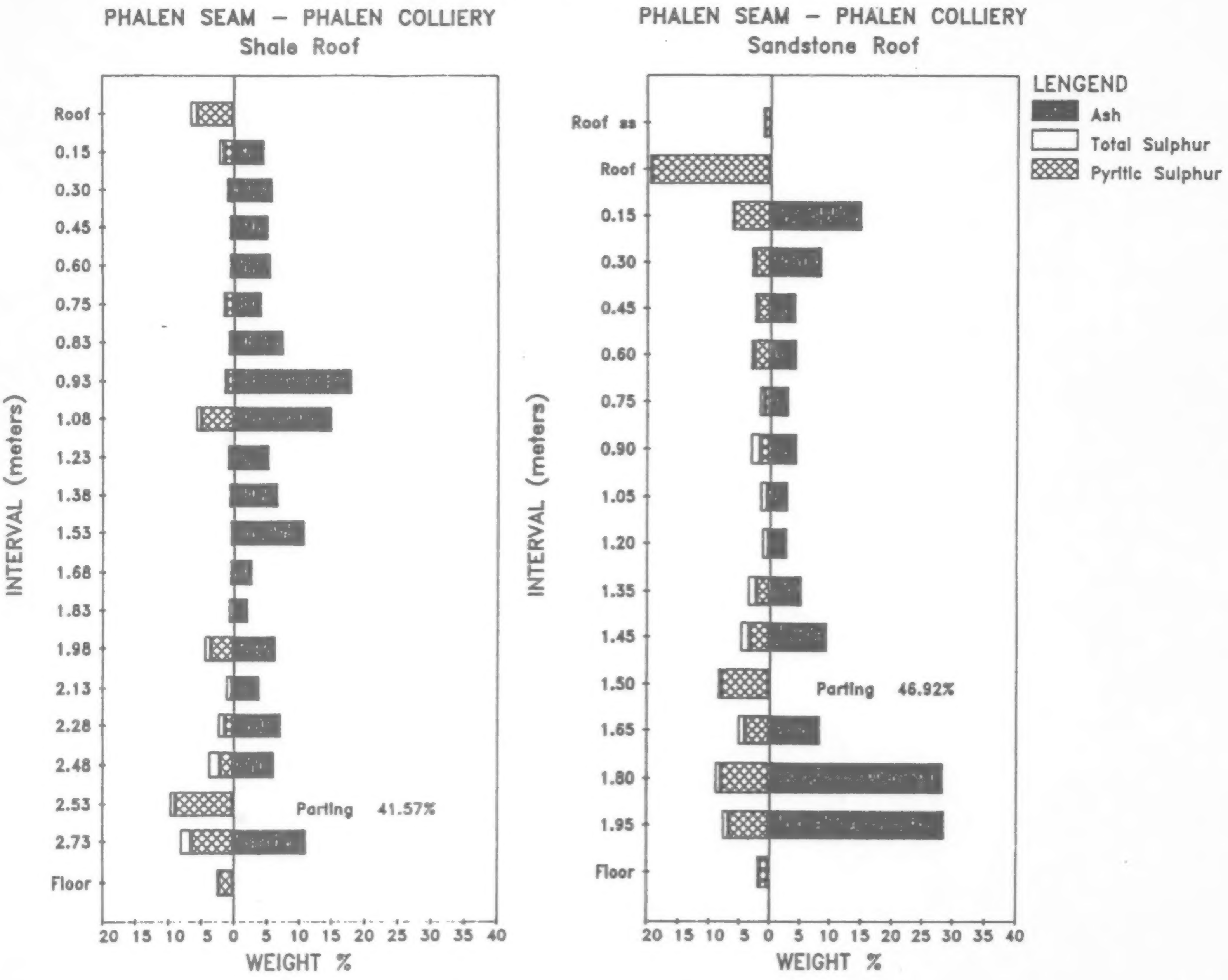
FIGURE II.2



HARBOUR SEAM – LINGAN MINE
Shale Roof

HARBOUR SEAM – LINGAN MINE
Sandstone Roof

FIGURE II.3



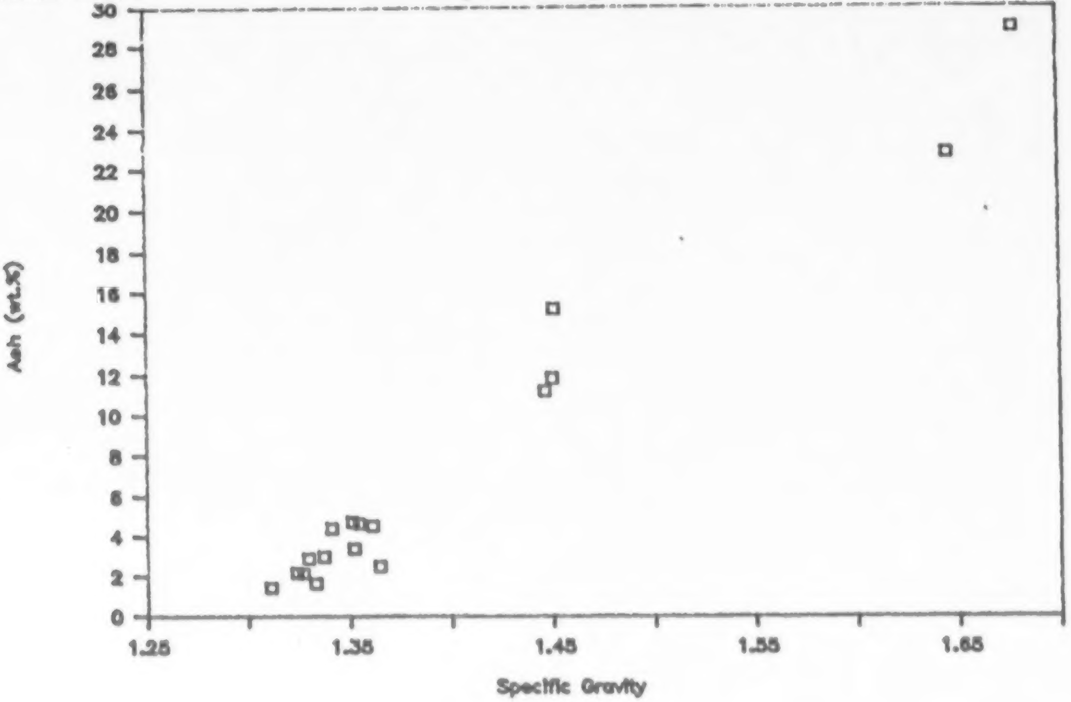
PHALEN SEAM – PHALEN COLLIERY
Shale Roof

PHALEN SEAM – PHALEN COLLIERY
Sandstone Roof

HUB SEAM – SHALE ROOF

FIGURE II.4

Specific Gravity vs Ash



HUB SEAM – SANDSTONE ROOF

FIGURE II.5

Specific Gravity vs Ash

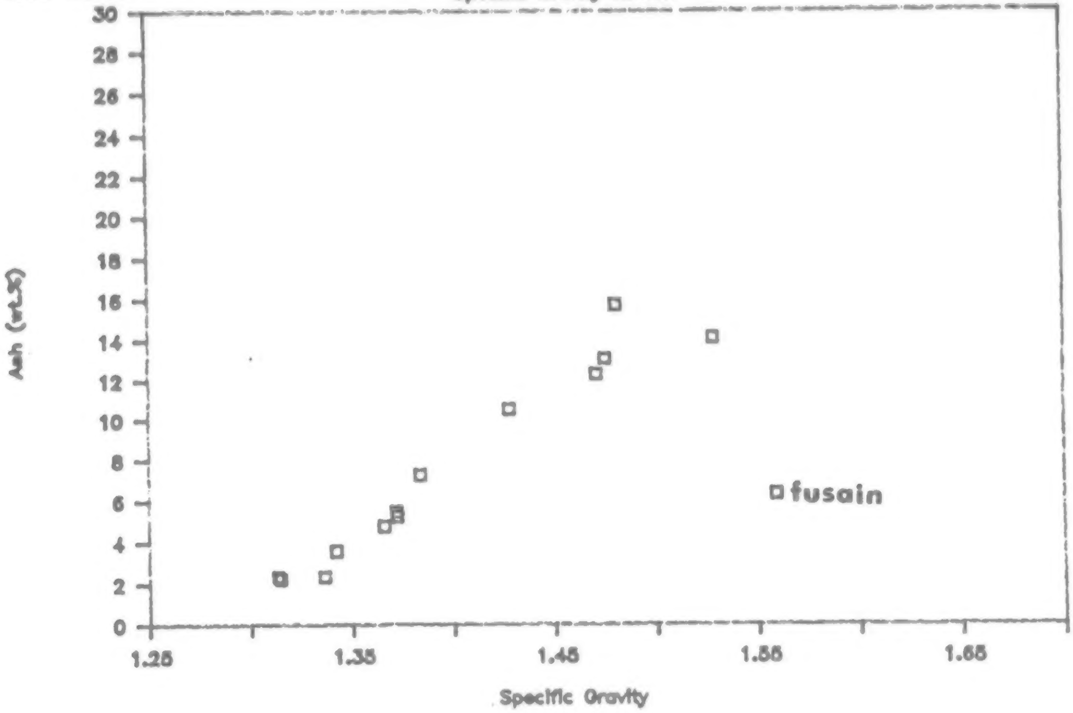


FIGURE II.6

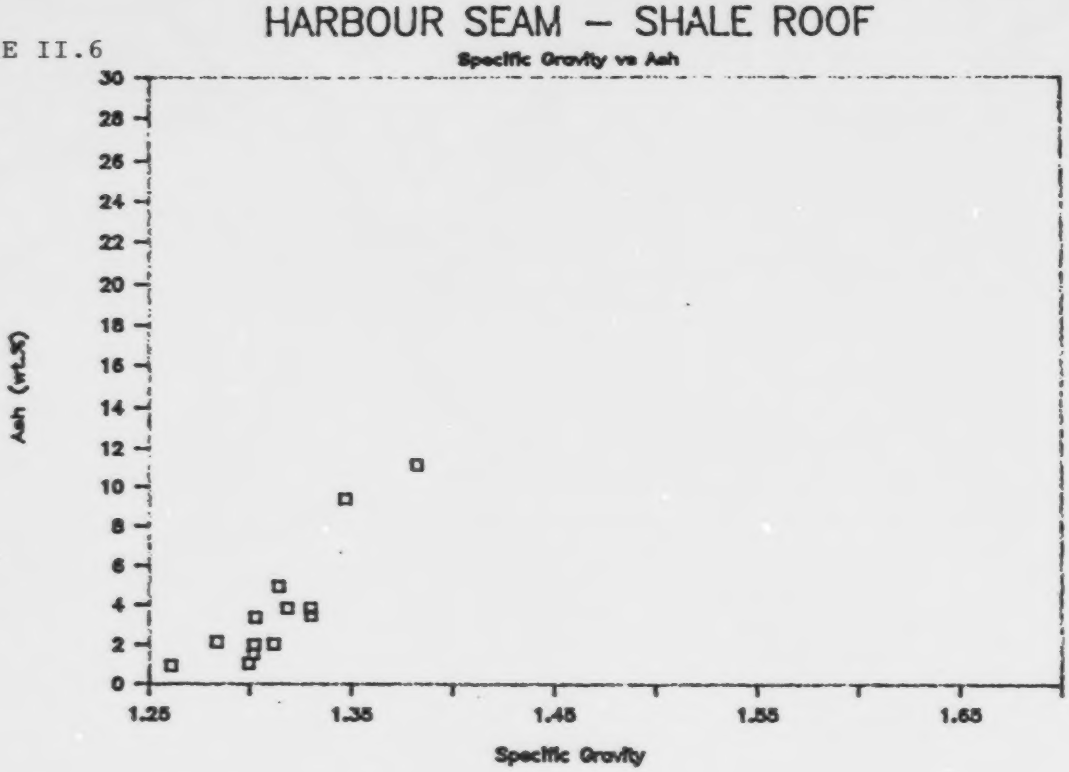


FIGURE II.7

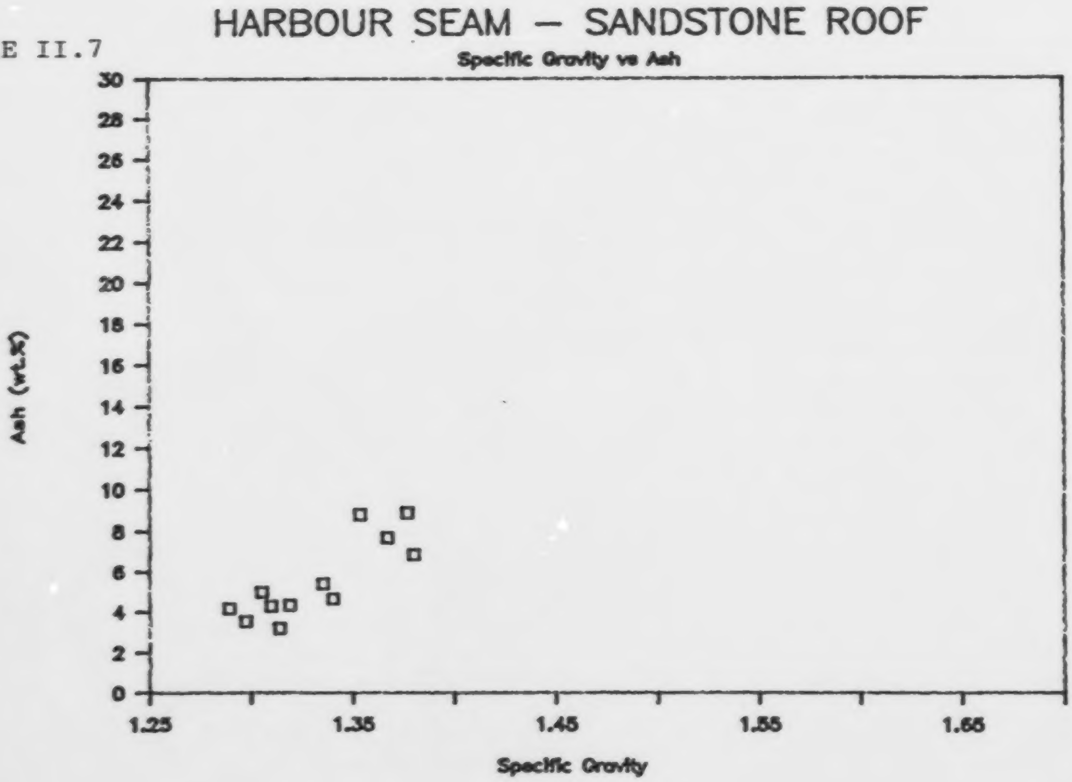


FIGURE II.8

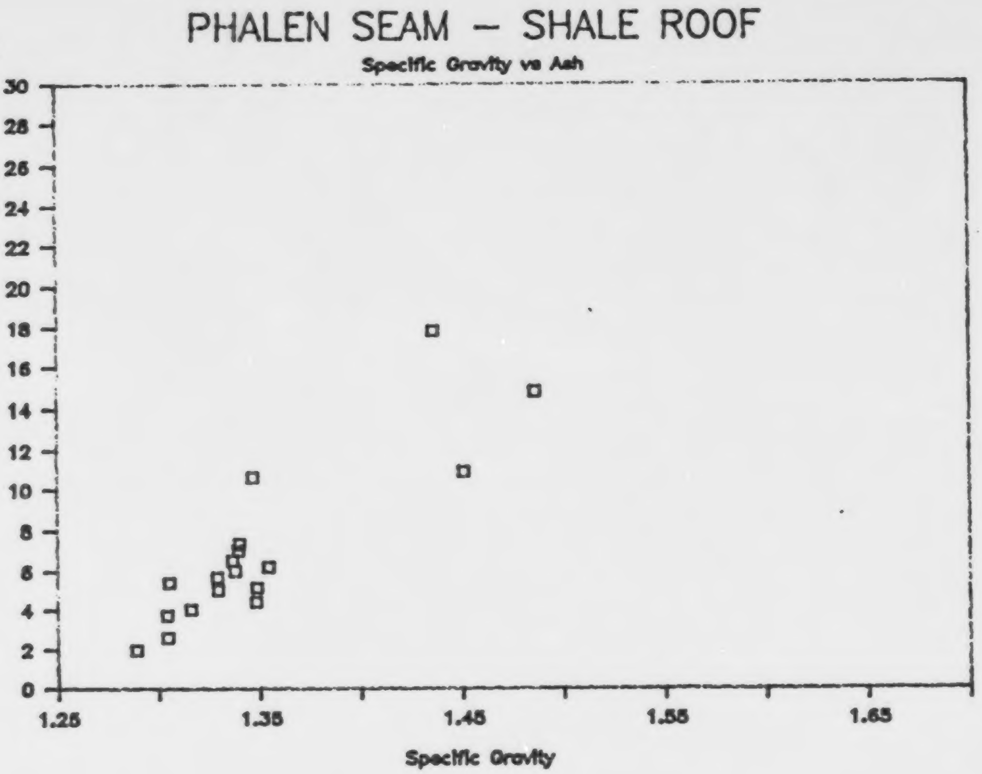
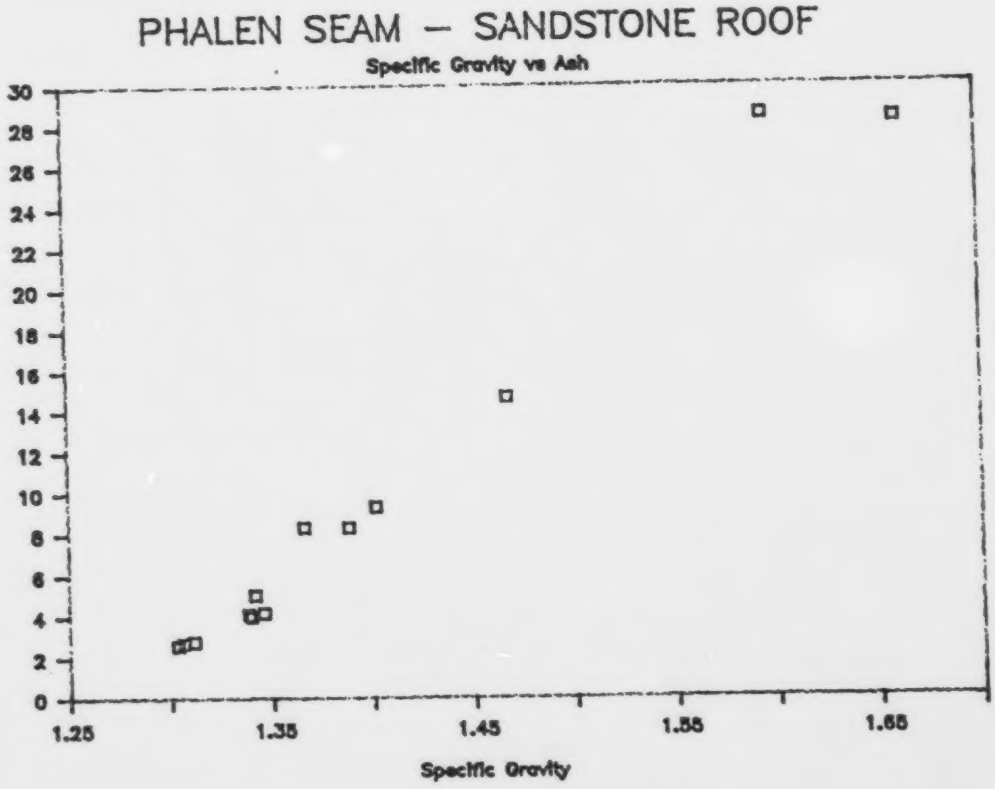


FIGURE II.9



APPENDIX II

C. Major and Trace Element Analysis

APPENDIX II C. MAJOR AND TRACE ELEMENT ANALYSIS

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TABLE II.5 Analytical method and detection limit for each element.

GROUP	ELEMENT	ANALYSIS	DETECTION LIMIT	GROUP	ELEMENT	ANALYSIS	DETECTION LIMIT
MAJOR	SiO_2 %	XRF	0.01				
OXIDES	Al_2O_3 %	XRF	0.01	TRACE	Ag ppm	DCP	0.5
	CaO %	XRF	0.01	ELEMENTS	As ppm	FAA	0.1
	MgO %	XRF,DCP	0.01		Au ppb	FADCP	1
	Na_2O %	XRF	0.01		B ppm	DCP	10
	K_2O %	XRF	0.01		Ba ppm	XRF	10
	Fe_2O_3 %	XRF	0.01		Be ppm	DCP	1
	MnO %	DCP,XRF	0.0002,0.01		Bi ppm	ICPMS	0.1
	TiO_2 %	XRF	0.01		Cd ppm	DCP	0.2
	P_2O_5 %	DCP,XRF	0.001,0.01		Co ppm	ICP,ICPMS	1
					Cr ppm	DCP	2
MAJOR	Si %	CAL			Cs ppm	NA,ICPMS	1
ELEMENTS	Al %	CAL			Cu ppm	DCP	0.5
	Ca %	CAL			Ga ppm	ICP,ICPMS	0.1
	Mg %	CAL			Ge ppm	DCP	10
	Na %	CAL			Hf ppm	NA,ICPMS	1
	K %	CAL			Hg ppm	WET	5
	Fe %	CAL			In ppm	ICP,ICPMS	1
	Mn %	DCP,CAL			Li ppm	AA	1
	Ti %	CAL			Mo ppm	ICP,ICPMS	1
	P %	DCP,CAL			Nb ppm	XRF,ICPMS	1
					Ni ppm	DCP	1
RARE	La ppm	ICPMS	0.1		Pb ppm	DCP	2
EARTH	Ce ppm	ICPMS	0.1		Rb ppm	XRF,ICPMS	1
ELEMENTS	Pr ppm	ICPMS	0.1		Sb ppm	FAA	0.2
	Nd ppm	ICPMS	0.1		Sc ppm	ICP,ICPMS	1
	Sm ppm	ICPMS	0.1		Se ppm	GFAA	0.5
	Eu ppm	ICPMS	0.05		Sn ppm	XRF	2
	Gd ppm	ICPMS	0.1		Sr ppm	ICPMS	1
	Tb ppm	ICPMS	0.1		Ta ppm	NA,ICPMS	1
	Dy ppm	ICPMS	0.1		Th ppm	NA,ICPMS	0.5
	Ho ppm	ICPMS	0.05		Tl ppm	ICPMS	0.1
	Er ppm	ICPMS	0.1		U ppm	NA,ICPMS	0.1
	Tm ppm	ICPMS	0.1		V ppm	DCP	2
	Yb ppm	ICPMS	0.1		W ppm	NA,ICPMS	1
	Lu ppm	ICPMS	0.05		Y ppm	ICP,ICPMS	1
					Zn ppm	DCP	0.5
					Zr ppm	ICP,ICPMS	1

XRF	Xray Fluorescence	AA	Atomic Absorption
DCP	Direct Coupled Plasma	FAA	Flame Atomic Absorption
ICP	Inductively Coupled Plasma	FADCP	Fire Assay DCP
CAL	Calculated	NA	Neutron Activation
ICPMS	Inductively Coupled Plasma/Mass Spectrometry		

TABLE II.6 Major oxide data of selected coal seams - Sydney Basin ASH

SEAM		SiO2 wt%	Al2O3 wt%	CaO wt%	MgO wt%	Na2O wt%	K2O wt%	Fe2O3 wt%	MnO wt%	TiO2 wt%	P2O5 wt%	LOI wt%	SUM wt%
Hub Seam/ Prince Mine: Shale Roof	Roof	56.5	29.6	0.23	0.78	0.48	2.89	3.34	0.013	1.23	0.21	3.70	99.0
	0.00 - 0.08	29.1	18.5	0.27	0.51	0.34	1.74	46.6	0.012	0.58	0.07	2.77	100.5
	0.08 - 0.23	39.5	24.9	1.77	0.80	1.11	1.39	25.2	0.026	1.22	0.055	3.16	99.1
	0.23 - 0.38	22.4	14.9	1.89	0.68	0.94	0.25	54.6	0.035	0.69	0.048	3.85	100.3
	0.38 - 0.53	41.1	29.4	3.53	0.89	1.78	0.71	15.3	0.043	1.29	0.073	6.16	100.3
	0.53 - 0.68	32.4	21.8	1.86	0.70	1.01	0.81	36.0	0.026	1.22	0.062	2.85	98.7
	0.68 - 0.83	32.5	27.3	7.84	1.82	2.54	0.80	14.0	0.24	1.02	0.099	7.47	95.6
	0.83 - 0.98	35.0	28.7	5.73	1.67	2.42	0.88	12.5	0.20	1.12	0.089	7.62	95.9
	0.98 - 1.13	35.4	26.1	4.62	1.55	1.87	0.87	21.1	0.18	1.32	0.089	4.92	98.0
	1.13 - 1.28	26.0	15.1	3.04	1.33	1.06	0.75	48.2	0.16	1.41	0.078	3.23	100.4
	1.28 - 1.43	11.1	9.45	2.79	1.04	1.46	0.28	66.2	0.10	0.39	0.060	3.39	96.3
	1.43 - 1.58	9.96	7.99	2.37	1.13	0.85	0.33	72.1	0.12	0.29	0.05	4.50	99.7
	1.58 - 1.73	22.1	16.9	3.86	1.38	2.04	0.89	42.2	0.13	0.89	0.15	7.00	97.5
	1.73 - 1.88	34.5	23.5	1.69	0.85	0.83	1.57	32.3	0.037	0.91	0.12	3.39	99.7
	1.88 - 2.03	29.6	12.1	0.63	0.26	0.43	0.70	52.8	0.02	1.04	0.28	2.31	100.2
	2.03 - 2.18	20.2	11.5	0.82	0.40	0.41	0.83	62.8	0.06	0.52	0.05	1.70	99.3
	2.18 - 2.33	29.4	13.8	0.60	0.43	0.43	1.41	50.4	0.017	0.83	0.021	1.62	99.0
	2.33 - 2.43	17.4	8.89	0.24	0.33	0.26	1.02	69.0	0.010	0.42	0.018	1.62	99.2
	Floor	57.3	25.7	0.12	0.97	0.51	4.18	5.89	0.017	0.99	0.06	3.47	99.2
	Average*	27.6	18.3	2.60	0.93	1.18	0.88	42.3	0.085	0.90	0.084	3.98	98.78
Hub Seam/ Prince Mine: Sandstone Roof	Roof	88.7	4.17	0.13	0.13	0.13	0.41	4.51	0.013	0.27	0.010	0.70	99.2
	0.00 - 0.15	9.03	4.69	0.68	0.25	0.32	0.22	83.4	0.02	0.24	0.05	0.85	99.8
	0.15 - 0.30	13.8	9.57	0.51	0.25	0.42	0.38	72.9	0.009	0.67	0.021	1.54	100.1
	0.30 - 0.45	14.1	10.3	0.89	0.60	0.67	0.23	69.3	0.012	0.46	0.05	2.16	98.8
	0.45 - 0.47	na	na	na	na	na	na	na	na	na	na	na	na
	0.47 - 0.62	37.5	27.4	0.50	0.63	0.70	3.41	24.9	0.007	1.01	0.08	2.31	98.4
	0.62 - 0.77	26.2	22.1	2.35	0.83	1.68	0.78	41.8	0.045	0.63	0.044	3.54	100.0
	0.77 - 0.92	18.9	15.1	1.41	0.70	0.95	0.67	58.4	0.025	0.48	0.039	2.77	99.4
	0.92 - 1.07	40.1	32.1	3.05	0.97	2.20	1.42	13.2	0.08	1.35	0.069	5.47	100.0
	1.07 - 1.22	33.2	25.3	3.62	1.29	2.61	1.05	21.7	0.09	2.30	0.12	6.93	98.2
	1.22 - 1.37	11.4	9.18	4.16	1.78	1.38	0.44	60.8	0.340	0.44	0.073	4.93	94.9
	1.37 - 1.52	26.6	19.4	2.23	1.15	1.56	1.87	40.7	0.044	0.58	0.12	5.62	99.9
	Parting 0.01	53.9	32.7	0.27	0.10	0.54	1.40	5.99	0.005	1.83	0.11	2.62	99.5
	1.53 - 1.68	17.4	10.9	1.68	0.71	0.45	0.60	64.0	0.16	0.49	0.21	2.39	99.0
	1.68 - 1.83	26.9	15.0	2.01	0.95	0.57	1.18	49.0	0.20	0.82	0.27	2.93	99.8
	1.83 - 1.98	24.6	13.0	2.74	1.05	0.45	1.27	51.5	0.28	0.78	0.05	2.31	98.0
	Floor	65.4	21.5	0.11	0.83	0.40	3.28	3.41	0.019	1.27	0.018	1.93	98.2
	Average*	23.2	16.4	1.94	0.84	1.04	1.05	50.2	0.100	0.79	0.093	3.30	98.96

TABLE II.6 Major oxide data of selected coal seams - Sydney Basin ASH

SEAM		SiO_2 wt%	Al_2O_3 wt%	CaO wt%	MgO wt%	Na_2O wt%	K_2O wt%	Fe_2O_3 wt%	MnO wt%	TiO_2 wt%	P_2O_5 wt%	LOI wt%	SUM wt%
Harbour Seam/	Roof	53.3	29.5	0.13	1.28	0.59	4.04	5.11	0.013	1.01	0.09	3.47	98.5
Lingan Mine:													
Shale	0.00 - 0.15	25.0	19.8	5.26	0.60	0.26	0.45	43.4	0.03	0.45	2.16	2.46	99.9
Roof	0.15 - 0.30	12.0	7.80	1.24	0.58	0.29	0.22	74.6	0.027	0.42	0.15	1.70	99.0
	0.30 - 0.45	11.5	7.20	0.76	0.63	0.42	0.23	77.0	0.048	0.54	0.071	1.54	99.9
	0.45 - 0.58	33.7	28.5	3.18	1.73	1.19	0.41	22.6	0.39	1.03	0.24	6.16	99.1
	0.58 - 0.63	37.7	22.8	0.93	1.80	0.77	0.46	30.3	0.034	1.57	0.085	2.23	98.7
	0.63 - 0.75	32.8	22.8	3.38	1.81	1.50	0.62	27.6	0.050	1.28	0.076	2.31	94.3
	0.75 - 0.90	16.9	13.9	6.99	2.90	0.85	0.28	37.9	2.98	0.42	0.73	9.31	93.2
	0.90 - 1.05	36.4	22.9	3.97	1.93	1.33	1.13	25.1	0.25	1.08	0.17	3.62	97.9
	1.05 - 1.20	52.6	25.0	0.75	0.74	0.48	0.86	14.9	0.013	1.55	0.18	1.93	99.0
	1.20 - 1.35	14.0	9.73	2.70	0.74	0.65	0.25	68.0	0.045	0.33	0.105	2.31	98.9
	1.35 - 1.50	29.3	21.8	12.5	1.76	1.69	0.35	17.7	0.50	0.59	0.25	5.54	92.0
	1.50 - 1.65	40.0	18.6	1.60	0.65	0.42	0.87	33.5	0.017	1.15	0.089	2.70	99.6
	1.65 - 1.80	34.0	19.1	4.60	0.84	0.65	1.80	31.9	0.039	0.76		3.85	97.5
	Floor	54.8	25.6	0.99	1.29	0.62	4.22	5.95	0.022	0.90	0.07	3.39	97.8
	Average*	28.3	18.0	3.84	1.23	0.79	0.62	39.7	0.359	0.81	0.358	3.55	97.61
Harbour Seam/	Roof	67.1	15.5	0.35	1.09	0.46	1.88	7.66	0.044	1.33	0.11	2.47	98.0
Lingan Mine:													
Sandstone	0.00 - 0.15	28.4	10.6	1.47	0.41	0.27	0.68	53.9	0.10	0.65	0.18	1.77	98.4
Roof	0.15 - 0.30	10.2	6.66	1.24	0.26	0.22	0.20	78.2	0.16	0.46	0.21	1.77	99.6
	0.30 - 0.45	6.16	4.77	1.59	0.32	0.26	0.09	83.6	0.22	0.23	0.11	1.62	99.0
	0.45 - 0.55	13.9	8.67	2.30	0.63	0.42	0.22	70.9	0.27	0.74	0.096	1.85	100.0
	0.55 - 0.60	18.1	7.05	0.39	0.52	0.12	0.26	70.8	0.052	0.94	0.060	1.92	100.2
	0.60 - 0.75	13.2	8.84	1.49	0.58	0.46	0.23	71.7	0.16	0.57	0.069	2.47	99.8
	0.75 - 0.90	10.6	7.61	1.67	0.67	0.49	0.21	74.9	0.16	0.37	0.008	2.77	99.5
	0.90 - 1.05	14.0	9.78	4.17	0.35	0.48	0.30	66.0	0.28	0.40	0.08	2.47	98.3
	1.05 - 1.20	32.8	16.6	0.37	0.25	0.33	0.56	44.1	0.016	1.00	0.09	2.00	98.1
	1.20 - 1.35	12.4	10.1	0.62	0.55	0.38	0.16	72.6	0.045	0.24	0.066	2.00	99.2
	1.35 - 1.50	13.9	9.10	0.95	0.62	0.61	0.18	71.4	0.035	0.34	0.12	2.54	99.8
	1.50 - 1.65	35.4	14.3	0.61	0.27	0.35	0.90	43.2	0.010	1.04	0.08	1.85	98.0
	Average*	17.6	9.72	1.43	0.44	0.38	0.34	66.2	0.124	0.56	0.100	2.10	99.05

TABLE II.6 Major oxide data of selected coal seams - Sydney Basin ASH

SEAM		SiO_2 wt%	Al_2O_3 wt%	CaO wt%	MgO wt%	Na_2O wt%	K_2O wt%	Fe_2O_3 wt%	MnO wt%	TiO_2 wt%	P_2O_5 wt%	LOI wt%	SUM wt%
Phalen Seam/	Roof	48.1	25.9	0.26	1.27	0.39	3.36	16.0	0.015	0.97	0.13	2.46	98.9
Phalen Colliery:													
Shale	0.00 - 0.15	13.1	7.27	16.0	0.78	1.34	0.25	52.5	0.18	0.32	0.080	6.23	98.1
Roof	0.15 - 0.30	37.8	17.5	13.4	0.86	0.77	1.34	15.4	0.13	0.93	0.048	7.62	95.8
	0.30 - 0.45	33.8	17.1	21.5	1.06	0.61	1.38	5.42	0.19	0.84	0.066	10.6	92.6
	0.45 - 0.60	55.7	26.2	2.43	1.09	0.69	2.19	6.82	0.021	1.43	0.064	3.08	99.7
	0.60 - 0.75	26.1	15.3	6.07	0.82	0.62	0.84	39.6	0.08	0.55	0.078	3.77	93.8
	0.75 - 0.83	47.0	30.3	4.38	1.12	0.70	3.01	7.26	0.043	0.77	0.089	3.39	98.1
	0.83 - 0.93	44.9	26.8	6.35	1.23	0.61	3.07	9.39	0.08	0.77	0.085	6.11	99.4
	0.93 - 1.08	25.3	14.3	4.70	0.81	0.27	1.30	44.6	0.058	0.53	0.055	2.31	94.2
	1.08 - 1.23	17.5	11.7	29.3	0.74	0.43	0.53	9.86	0.34	0.45	0.053	10.5	81.4
	1.23 - 1.38	43.0	25.3	11.8	0.96	0.70	1.65	3.48	0.13	1.08	0.099	5.69	93.9
	1.38 - 1.53	60.8	26.3	1.15	0.85	0.58	2.23	2.99	0.013	1.97	0.073	2.31	99.3
	1.53 - 1.68	26.5	19.0	23.2	1.03	1.75	0.66	2.57	0.23	0.60	0.076	8.16	83.8
	1.68 - 1.83	27.2	10.8	24.5	1.36	2.59	0.39	2.00	0.27	0.43	0.096	5.08	74.7
	1.83 - 1.98	10.3	4.08	3.23	0.64	0.58	0.16	78.1	0.028	0.24	0.039	2.62	100.0
	1.98 - 2.13	26.2	10.1	21.4	1.05	1.81	0.42	12.2	0.21	0.51	0.14	5.16	79.2
	2.13 - 2.28	14.4	4.99	21.3	0.71	0.70	0.28	29.7	0.26	0.28	0.121	3.85	76.6
	2.28 - 2.48	13.8	5.23	12.2	0.68	0.57	0.24	50.0	0.15	0.27	0.76	1.85	85.8
	Parting 0.05	43.2	18.1	2.77	0.67	0.27	1.37	29.6	0.028	0.85	1.66	1.77	100.3
	2.53 - 2.73	7.46	4.02	3.67	0.60	0.43	0.23	77.7	0.11	0.24	0.72	2.39	97.6
	Floor	63.3	19.3	0.25	1.52	0.38	3.38	6.60	0.035	1.14	0.119	3.31	99.3
	Average"	28.6	14.6	12.34	0.88	0.85	1.03	27.3	0.14	0.67	0.21	4.90	91.48

TABLE II.6 Major oxide data of selected coal seams - Sydney Basin ASH

SEAM		SiO2 wt%	Al2O3 wt%	CaO wt%	MgO wt%	Na2O wt%	K2O wt%	Fe2O3 wt%	MnO wt%	TiO2 wt%	P2O5 wt%	LOI wt%	SUM wt%
Phalen Seam/		82.6	7.72	0.33	0.47	0.30	0.91	3.41	0.09	0.94	0.073	2.00	98.8
Phalen Colliery:	Roof	19.4	12.1	0.31	0.93	0.27	2.13	62.3	0.017	0.43	0.16	2.08	100.1
Sandstone													
Roof	0.00 - 0.15	30.1	16.6	0.97	0.94	0.44	1.98	43.8	0.027	0.91	0.23	3.08	99.1
	0.15 - 0.30	37.4	20.5	1.02	0.73	0.39	1.77	33.5	0.026	1.35	0.085	3.31	100.1
	0.30 - 0.45	19.2	13.5	1.67	0.67	0.55	0.59	57.0	0.032	0.60	0.12	3.31	97.2
	0.45 - 0.60	10.1	6.79	3.51	0.72	0.64	0.19	71.7	0.053	0.30	0.12	3.08	97.2
	0.60 - 0.75	21.7	7.02	10.9	0.95	1.24	0.26	37.6	0.19	0.35	0.12	3.85	84.2
	0.75 - 0.90	15.8	6.51	7.24	0.71	0.73	0.27	56.3	0.12	0.34	0.055	4.00	92.1
	0.90 - 1.05	31.3	12.3	11.9	0.95	1.26	0.48	21.6	0.14	0.73	0.12	5.16	85.9
	1.05 - 1.20	31.4	12.2	17.5	1.18	1.79	0.35	10.8	0.20	0.59	0.092	7.08	83.2
	1.20 - 1.35	17.1	5.88	5.98	0.82	1.10	0.20	56.8	0.056	0.31	0.23	3.54	92.0
	1.35 - 1.45	28.2	12.6	3.40	0.82	0.61	1.10	47.3	0.037	0.65	0.98	3.23	98.9
	Parting 0.05	46.6	20.5	3.74	0.88	0.34	1.66	22.1	0.026	0.96	2.06	1.47	100.3
	1.50 - 1.65	21.6	10.6	2.75	0.71	0.43	0.85	58.6	0.037	0.54	1.06	2.54	99.7
	1.65 - 1.80	38.9	16.9	2.96	0.85	0.35	1.38	35.1	0.032	0.84	1.75	0.85	99.9
	1.80 - 1.95	40.1	17.5	3.38	0.88	0.35	1.49	32.2	0.044	0.82	1.90	0.93	99.6
	Floor	58.5	22.7	0.33	2.07	0.55	4.18	6.41	0.028	1.08	0.13	4.00	100.0
	Average*	27.5	12.7	5.44	0.84	0.73	0.89	42.3	0.073	0.66	0.612	3.22	94.93

TABLE II.7 Calculated major element data of selected coal seams - Sydney Basin ASH

SEAM		Si wt%	Al wt%	Ca wt%	Mg wt%	Na wt%	K wt%	Fe wt%	Mn wt%	Ti wt%	P wt%
Hub Seam/ Prince Mine: Shale Roof	Roof	26.4	15.7	0.16	0.47	0.36	2.40	2.34	0.010	0.74	0.09
	0.00 - 0.08	13.6	9.79	0.19	0.31	0.25	1.44	32.6	0.009	0.35	0.03
	0.08 - 0.23	18.5	13.2	1.27	0.48	0.82	1.15	17.6	0.020	0.73	0.024
	0.23 - 0.38	10.5	7.89	1.35	0.41	0.70	0.21	38.2	0.027	0.41	0.021
	0.38 - 0.53	19.2	15.6	2.52	0.54	1.32	0.59	10.7	0.033	0.77	0.032
	0.53 - 0.68	15.1	11.5	1.33	0.42	0.75	0.67	25.2	0.020	0.73	0.027
	0.68 - 0.83	15.2	14.5	5.60	1.10	1.88	0.66	9.79	0.19	0.61	0.043
	0.83 - 0.98	16.4	15.2	4.10	1.01	1.80	0.73	8.74	0.15	0.67	0.039
	0.98 - 1.13	16.5	13.8	3.30	0.93	1.39	0.72	14.8	0.14	0.79	0.039
	1.13 - 1.28	12.2	7.99	2.17	0.80	0.79	0.62	33.7	0.12	0.85	0.034
	1.28 - 1.43	5.19	5.00	1.99	0.63	1.08	0.23	46.3	0.08	0.23	0.026
	1.43 - 1.58	4.66	4.23	1.69	0.68	0.63	0.27	50.4	0.09	0.17	0.02
	1.58 - 1.73	10.3	8.95	2.76	0.83	1.51	0.74	29.5	0.10	0.53	0.07
	1.73 - 1.88	16.1	12.4	1.21	0.51	0.62	1.30	22.6	0.029	0.55	0.05
	1.88 - 2.03	13.8	6.41	0.45	0.16	0.32	0.58	36.9	0.02	0.62	0.12
	2.03 - 2.18	9.44	6.09	0.59	0.24	0.30	0.69	43.9	0.05	0.31	0.02
	2.18 - 2.33	13.7	7.31	0.43	0.26	0.32	1.17	35.2	0.013	0.50	0.009
	2.33 - 2.43	8.13	4.71	0.17	0.20	0.19	0.85	48.3	0.008	0.25	0.008
	Floor	26.8	13.61	0.09	0.59	0.38	3.47	4.12	0.013	0.59	0.03
	Average"	12.9	9.68	1.86	0.56	0.87	0.73	29.6	0.065	0.54	0.037
Hub Seam/ Prince Mine: Sandstone Roof	Roof	41.5	2.21	0.09	0.08	0.10	0.34	3.15	0.010	0.16	0.004
	0.00 - 0.15	4.22	2.48	0.49	0.15	0.24	0.18	58.3	0.02	0.14	0.02
	0.15 - 0.30	6.45	5.07	0.36	0.15	0.31	0.32	51.0	0.007	0.40	0.009
	0.30 - 0.45	6.59	5.45	0.64	0.36	0.50	0.19	48.5	0.009	0.28	0.02
	0.45 - 0.47	na	na	na	na	na	na	na	na	na	na
	0.47 - 0.62	17.5	14.5	0.36	0.38	0.52	2.83	17.4	0.005	0.61	0.03
	0.62 - 0.77	12.2	11.7	1.68	0.50	1.25	0.65	29.2	0.035	0.38	0.019
	0.77 - 0.92	8.84	7.99	1.01	0.42	0.70	0.56	40.8	0.019	0.29	0.017
	0.92 - 1.07	18.7	17.0	2.18	0.59	1.63	1.18	9.23	0.06	0.81	0.030
	1.07 - 1.22	15.5	13.4	2.59	0.78	1.94	0.87	15.2	0.07	1.38	0.05
	1.22 - 1.37	5.33	4.86	2.97	1.07	1.02	0.37	42.5	0.263	0.26	0.032
	1.37 - 1.52	12.4	10.3	1.59	0.69	1.16	1.55	28.5	0.034	0.35	0.05
	Parting 0.01	25.2	17.3	0.19	0.06	0.40	1.16	4.19	0.004	1.10	0.05
	1.53 - 1.68	8.13	5.77	1.20	0.43	0.33	0.50	44.8	0.12	0.29	0.09
	1.68 - 1.83	12.6	7.94	1.44	0.57	0.42	0.98	34.3	0.15	0.49	0.12
	1.83 - 1.98	11.5	6.88	1.96	0.63	0.33	1.05	36.0	0.22	0.47	0.02
	Floor	30.6	11.4	0.08	0.50	0.30	2.72	2.38	0.015	0.76	0.008
	Average'	10.8	8.70	1.39	0.51	0.77	0.87	35.1	0.078	0.47	0.040

TABLE II.7 Calculated major element data of selected coal seams - Sydney Basin ASH

SEAM		Si wt%	Al wt%	Ca wt%	Mg wt%	Na wt%	K wt%	Fe wt%	Mn wt%	Ti wt%	P wt%
Harbour Seam/	Roof	24.9	15.6	0.09	0.77	0.44	3.35	3.57	0.010	0.61	0.04
Lingan Mine:											
Shale	0.00 - 0.15	11.7	10.5	3.76	0.36	0.19	0.37	30.3	0.02	0.27	0.94
Roof	0.15 - 0.30	5.61	4.13	0.89	0.35	0.22	0.18	52.2	0.021	0.25	0.07
	0.30 - 0.45	5.38	3.81	0.54	0.38	0.31	0.19	53.8	0.037	0.32	0.031
	0.45 - 0.58	15.8	15.1	2.27	1.04	0.88	0.34	15.8	0.30	0.62	0.10
	0.58 - 0.63	17.6	12.1	0.66	1.09	0.57	0.38	21.2	0.026	0.94	0.037
	0.63 - 0.75	15.3	12.1	2.42	1.09	1.11	0.51	19.3	0.039	0.77	0.033
	0.75 - 0.90	7.90	7.36	5.00	1.75	0.63	0.23	26.5	2.31	0.25	0.32
	0.90 - 1.05	17.0	12.1	2.84	1.16	0.99	0.94	17.6	0.19	0.65	0.07
	1.05 - 1.20	24.6	13.2	0.54	0.45	0.36	0.71	10.4	0.010	0.93	0.08
	1.20 - 1.35	6.55	5.15	1.93	0.45	0.48	0.21	47.6	0.035	0.20	0.046
	1.35 - 1.50	13.7	11.5	8.93	1.06	1.25	0.29	12.4	0.39	0.35	0.11
	1.50 - 1.65	18.7	9.85	1.14	0.39	0.31	0.72	23.4	0.013	0.69	0.039
	1.65 - 1.80	15.9	10.1	3.29	0.51	0.48	1.49	22.3	0.030	0.46	
	Floor	25.6	13.6	0.71	0.77	0.46	3.50	4.16	0.017	0.54	0.03
	Average"	13.2	9.53	2.74	0.74	0.58	0.51	27.8	0.278	0.49	0.156
Harbour Seam/	Roof	31.4	8.21	0.25	0.66	0.34	1.56	5.36	0.034	0.80	0.05
Lingan Mine:											
Sandstone	0.00 - 0.15	13.3	5.61	1.05	0.25	0.20	0.56	37.7	0.08	0.39	0.08
Roof	0.15 - 0.30	4.77	3.53	0.89	0.16	0.16	0.17	54.7	0.12	0.28	0.09
	0.30 - 0.45	2.88	2.53	1.14	0.19	0.19	0.07	58.5	0.17	0.14	0.05
	0.45 - 0.55	6.50	4.59	1.64	0.38	0.31	0.18	49.6	0.21	0.44	0.042
	0.55 - 0.60	8.46	3.73	0.28	0.31	0.09	0.22	49.5	0.040	0.56	0.026
	0.60 - 0.75	6.17	4.68	1.07	0.35	0.34	0.19	50.1	0.12	0.34	0.030
	0.75 - 0.90	4.96	4.03	1.19	0.40	0.36	0.17	52.4	0.12	0.22	0.003
	0.90 - 1.05	6.55	5.18	2.98	0.21	0.36	0.25	46.2	0.22	0.24	0.03
	1.05 - 1.20	15.3	8.79	0.26	0.15	0.24	0.46	30.8	0.012	0.60	0.04
	1.20 - 1.35	5.80	5.35	0.44	0.33	0.28	0.13	50.8	0.035	0.14	0.029
	1.35 - 1.50	6.50	4.82	0.68	0.37	0.45	0.15	49.9	0.027	0.20	0.05
	1.50 - 1.65	16.5	7.57	0.44	0.16	0.26	0.75	30.2	0.008	0.62	0.03
	Average"	8.25	5.15	1.02	0.27	0.28	0.29	46.3	0.096	0.33	0.043

TABLE II.7 Calculated major element data of selected coal seams - Sydney Basin ASH

SEAM		Si wt%	Al wt%	Ca wt%	Mg wt%	Na wt%	K wt%	Fe wt%	Mn wt%	Ti wt%	P wt%
Phalen Seam/ Phalen Colliery:	Roof	22.5	13.7	0.19	0.77	0.29	2.79	11.2	0.012	0.58	0.06
Shale Roof	0.00 - 0.15	6.12	3.85	11.4	0.47	0.99	0.21	36.7	0.14	0.19	0.035
	0.15 - 0.30	17.7	9.26	9.58	0.52	0.57	1.11	10.8	0.10	0.56	0.021
	0.30 - 0.45	15.8	9.05	15.4	0.64	0.45	1.15	3.79	0.15	0.50	0.029
	0.45 - 0.60	26.0	13.9	1.74	0.66	0.51	1.82	4.77	0.016	0.86	0.028
	0.60 - 0.75	12.2	8.10	4.34	0.49	0.46	0.70	27.7	0.06	0.33	0.034
	0.75 - 0.83	22.0	16.0	3.13	0.68	0.52	2.50	5.08	0.033	0.46	0.039
	0.83 - 0.93	21.0	14.2	4.54	0.74	0.45	2.55	6.57	0.06	0.46	0.037
	0.93 - 1.08	11.8	7.57	3.36	0.49	0.20	1.08	31.2	0.045	0.32	0.024
	1.08 - 1.23	8.18	6.19	20.9	0.45	0.32	0.44	6.90	0.26	0.27	0.023
	1.23 - 1.38	20.1	13.4	8.43	0.58	0.52	1.37	2.43	0.10	0.65	0.043
	1.38 - 1.53	28.4	13.9	0.82	0.51	0.43	1.85	2.09	0.010	1.18	0.032
	1.53 - 1.68	12.4	10.1	16.6	0.62	1.30	0.55	1.80	0.18	0.36	0.033
	1.68 - 1.83	12.7	5.72	17.5	0.82	1.92	0.32	1.40	0.21	0.26	0.042
	1.83 - 1.98	4.82	2.16	2.31	0.39	0.43	0.13	54.6	0.022	0.14	0.017
	1.98 - 2.13	12.2	5.35	15.3	0.63	1.34	0.35	8.53	0.16	0.31	0.06
	2.13 - 2.28	6.73	2.64	15.2	0.43	0.52	0.23	20.8	0.20	0.17	0.053
	2.28 - 2.48	6.45	2.77	8.72	0.41	0.42	0.20	35.0	0.12	0.16	0.33
	Parting 0.05	20.2	9.58	1.98	0.40	0.20	1.14	20.7	0.022	0.51	0.72
	2.53 - 2.73	3.49	2.13	2.62	0.36	0.32	0.19	54.3	0.09	0.14	0.31
	Floor	29.6	10.2	0.18	0.92	0.28	2.80	4.62	0.027	0.68	0.052
	Average*	13.3	7.71	8.82	0.53	0.63	0.85	19.1	0.108	0.40	0.090

TABLE II.7 Calculated major element data of selected coal seams - Sydney Basin ASH

SEAM		Si wt%	Al wt%	Ca wt%	Mg wt%	Na wt%	K wt%	Fe wt%	Mn wt%	Ti wt%	P wt%
Phalen Seam/		38.6	4.09	0.24	0.28	0.22	0.76	2.38	0.07	0.56	0.032
Phalen Colliery:	Roof	9.07	6.41	0.22	0.56	0.20	1.77	43.6	0.013	0.26	0.07
Sandstone Roof	0.00 - 0.15	14.1	8.79	0.69	0.57	0.33	1.64	30.6	0.021	0.55	0.10
	0.15 - 0.30	17.5	10.9	0.73	0.44	0.29	1.47	23.4	0.020	0.81	0.037
	0.30 - 0.45	8.98	7.15	1.19	0.40	0.41	0.49	39.9	0.025	0.36	0.05
	0.45 - 0.60	4.72	3.59	2.51	0.43	0.47	0.16	50.1	0.041	0.18	0.05
	0.60 - 0.75	10.1	3.72	7.79	0.57	0.92	0.22	26.3	0.15	0.21	0.05
	0.75 - 0.90	7.39	3.45	5.18	0.43	0.54	0.22	39.4	0.09	0.20	0.024
	0.90 - 1.05	14.6	6.51	8.51	0.57	0.93	0.40	15.1	0.11	0.44	0.05
	1.05 - 1.20	14.7	6.46	12.5	0.71	1.33	0.29	7.55	0.155	0.35	0.040
	1.20 - 1.35	7.99	3.11	4.27	0.49	0.82	0.17	39.7	0.043	0.19	0.10
	1.35 - 1.45	13.2	6.67	2.43	0.49	0.45	0.91	33.1	0.029	0.39	0.43
	Parting 0.05	21.8	10.9	2.67	0.53	0.25	1.38	15.5	0.020	0.58	0.90
	1.50 - 1.65	10.1	5.61	1.97	0.43	0.32	0.71	41.0	0.029	0.32	0.46
	1.65 - 1.80	18.2	8.95	2.12	0.51	0.26	1.15	24.5	0.025	0.50	0.76
	1.80 - 1.95	18.7	9.26	2.42	0.53	0.26	1.24	22.5	0.034	0.49	0.83
	Floor	27.3	12.0	0.24	1.25	0.41	3.47	4.48	0.022	0.65	0.06
	Average*	12.8	6.72	3.89	0.51	0.54	0.74	29.6	0.057	0.40	0.267

TABLE II.8 Calculated major oxide data of selected coal seams - Sydney Basin COAL

SEAM		SiO_2 wt%	Al_2O_3 wt%	CaO wt%	MgO wt%	Na_2O wt%	K_2O wt%	Fe_2O_3 wt%	MnO wt%	TiO_2 wt%	P_2O_5 wt%
Hub Seam/	Roof	48.9	25.6	0.20	0.68	0.42	2.50	2.89	0.011	1.06	0.192
Prince Mine:											
Shale	0.00 - 0.08	8.40	5.34	0.08	0.15	0.10	0.50	13.5	0.003	0.17	0.020
Roof	0.08 - 0.23	1.34	0.64	0.06	0.03	0.04	0.05	0.85	0.001	0.04	0.002
	0.23 - 0.38	0.67	0.44	0.06	0.02	0.03	0.01	1.62	0.001	0.02	0.001
	0.38 - 0.53	0.89	0.63	0.08	0.02	0.04	0.02	0.33	0.001	0.03	0.002
	0.53 - 0.68	1.43	0.96	0.08	0.03	0.04	0.04	1.59	0.001	0.05	0.003
	0.68 - 0.83	0.46	0.39	0.11	0.03	0.04	0.01	0.20	0.003	0.01	0.001
	0.83 - 0.98	0.57	0.47	0.09	0.03	0.04	0.01	0.21	0.003	0.02	0.001
	0.98 - 1.13	0.88	0.65	0.12	0.04	0.05	0.02	0.53	0.004	0.03	0.002
	1.13 - 1.28	1.21	0.70	0.14	0.06	0.05	0.03	2.24	0.007	0.07	0.004
	1.28 - 1.43	0.32	0.27	0.08	0.03	0.04	0.01	1.90	0.003	0.01	0.002
	1.43 - 1.58	0.45	0.36	0.11	0.05	0.04	0.01	3.27	0.005	0.01	0.002
	1.58 - 1.73	0.48	0.36	0.08	0.03	0.04	0.02	0.91	0.003	0.02	0.003
	1.73 - 1.88	1.63	1.11	0.08	0.04	0.04	0.07	1.53	0.002	0.04	0.006
	1.88 - 2.03	3.50	1.43	0.07	0.03	0.05	0.08	6.25	0.002	0.12	0.033
	2.03 - 2.18	2.26	1.29	0.09	0.04	0.05	0.09	7.03	0.007	0.06	0.006
	2.18 - 2.33	4.47	2.10	0.09	0.07	0.07	0.21	7.65	0.003	0.13	0.003
	2.33 - 2.43	3.96	2.02	0.05	0.08	0.06	0.23	15.7	0.002	0.10	0.004
	Floor	49.8	22.3	0.10	0.84	0.44	3.63	5.12	0.015	0.86	0.052
	Average*	1.92	1.28	0.18	0.07	0.08	0.06	2.95	0.006	0.06	0.006
Hub Seam/	Roof	85.3	4.01	0.13	0.13	0.13	0.39	4.34	0.013	0.26	0.010
Prince Mine:											
Sandstone	0.00 - 0.15	1.27	0.66	0.10	0.04	0.05	0.03	11.7	0.003	0.03	0.007
Roof	0.15 - 0.30	1.00	0.69	0.04	0.02	0.03	0.03	5.29	0.001	0.05	0.002
	0.30 - 0.45	0.77	0.56	0.05	0.03	0.04	0.01	3.79	0.001	0.03	0.003
	0.45 - 0.47	na	na	na	na	na	na	na	na	na	na
	0.47 - 0.62	5.89	4.30	0.08	0.10	0.11	0.54	3.91	0.001	0.16	0.013
	0.62 - 0.77	0.61	0.52	0.06	0.02	0.04	0.02	0.98	0.001	0.01	0.001
	0.77 - 0.92	0.99	0.79	0.07	0.04	0.05	0.04	3.06	0.001	0.03	0.002
	0.92 - 1.07	0.89	0.71	0.07	0.02	0.05	0.03	0.29	0.002	0.03	0.002
	1.07 - 1.22	0.78	0.59	0.08	0.03	0.06	0.02	0.51	0.002	0.05	0.003
	1.22 - 1.37	0.41	0.33	0.15	0.06	0.05	0.02	2.18	0.012	0.02	0.003
	1.37 - 1.52	1.27	0.93	0.11	0.05	0.07	0.09	1.95	0.002	0.03	0.006
	Parting 0.01	37.3	22.6	0.19	0.07	0.37	0.97	4.14	0.003	1.26	0.076
	1.53 - 1.68	1.83	1.15	0.18	0.07	0.05	0.06	6.72	0.017	0.05	0.022
	1.68 - 1.83	3.30	1.84	0.25	0.12	0.07	0.14	6.01	0.025	0.10	0.033
	1.83 - 1.98	3.21	1.69	0.36	0.14	0.06	0.17	6.71	0.036	0.10	0.007
	Floor	61.0	20.0	0.10	0.77	0.37	3.06	3.18	0.018	1.18	0.017
	Average*	1.93	1.36	0.16	0.07	0.09	0.09	4.16	0.008	0.07	0.008

TABLE II.8 Calculated major oxide data of selected coal seams - Sydney Basin COAL

SEAM		SiO_2 wt%	Al_2O_3 wt%	CaO wt%	MgO wt%	Na_2O wt%	K_2O wt%	Fe_2O_3 wt%	MnO wt%	TiO_2 wt%	P_2O_5 wt%
Harbour Seam/ Lingan Mine: Shale Roof	Roof	47.0	26.0	0.11	1.13	0.52	3.56	4.50	0.011	0.89	0.079
	0.00 - 0.15	2.79	2.21	0.59	0.07	0.03	0.05	4.85	0.003	0.05	0.241
	0.15 - 0.30	0.46	0.30	0.05	0.02	0.01	0.01	2.86	0.001	0.02	0.006
	0.30 - 0.45	0.39	0.24	0.03	0.02	0.01	0.01	2.59	0.002	0.02	0.002
	0.45 - 0.58	0.32	0.27	0.03	0.02	0.01	0.00	0.21	0.004	0.01	0.002
	0.58 - 0.63	0.75	0.45	0.02	0.04	0.02	0.01	0.60	0.001	0.03	0.002
	0.63 - 0.75	0.50	0.35	0.05	0.03	0.02	0.01	0.42	0.001	0.02	0.001
	0.75 - 0.90	0.34	0.28	0.14	0.06	0.02	0.01	0.76	0.060	0.01	0.015
	0.90 - 1.05	0.77	0.49	0.08	0.04	0.03	0.02	0.53	0.005	0.02	0.004
	1.05 - 1.20	4.93	2.34	0.07	0.07	0.04	0.08	1.40	0.001	0.15	0.017
	1.20 - 1.35	0.49	0.34	0.09	0.03	0.02	0.01	2.36	0.002	0.01	0.004
	1.35 - 1.50	0.30	0.23	0.13	0.02	0.02	0.00	0.18	0.005	0.01	0.003
	1.50 - 1.65	1.53	0.71	0.06	0.02	0.02	0.03	1.28	0.001	0.04	0.003
	1.65 - 1.80	1.68	0.94	0.23	0.04	0.03	0.09	1.57	0.002	0.04	0.000
	Floor	46.2	21.6	0.83	1.08	0.52	3.56	5.02	0.019	0.76	0.059
	Average*	1.15	0.73	0.16	0.05	0.03	0.03	1.61	0.015	0.03	0.015
Harbour Seam/ Lingan Mine: Sandstone Roof	Roof	53.4	12.3	0.28	0.87	0.37	1.50	6.10	0.035	1.06	0.088
	0.00 - 0.15	2.50	0.93	0.13	0.04	0.02	0.06	4.74	0.009	0.06	0.016
	0.15 - 0.30	0.51	0.33	0.06	0.01	0.01	0.01	3.90	0.008	0.02	0.010
	0.30 - 0.45	0.33	0.26	0.09	0.02	0.01	0.00	4.51	0.012	0.01	0.006
	0.45 - 0.55	0.58	0.36	0.10	0.03	0.02	0.01	2.95	0.011	0.03	0.004
	0.55 - 0.60	1.24	0.48	0.03	0.04	0.01	0.02	4.85	0.004	0.06	0.004
	0.60 - 0.75	0.56	0.38	0.06	0.02	0.02	0.01	3.07	0.007	0.02	0.003
	0.75 - 0.90	0.46	0.33	0.07	0.03	0.02	0.01	3.24	0.007	0.02	0.000
	0.90 - 1.05	0.50	0.35	0.15	0.01	0.02	0.01	2.34	0.010	0.01	0.003
	1.05 - 1.20	2.91	1.47	0.03	0.02	0.03	0.05	3.92	0.001	0.09	0.008
	1.20 - 1.35	0.58	0.47	0.03	0.03	0.02	0.01	3.37	0.002	0.01	0.003
	1.35 - 1.50	0.44	0.29	0.03	0.02	0.02	0.01	2.27	0.001	0.01	0.004
	1.50 - 1.65	2.72	1.10	0.05	0.02	0.03	0.07	3.32	0.001	0.08	0.006
	Average*	0.98	0.54	0.08	0.02	0.02	0.02	3.68	0.007	0.03	0.006

TABLE II.8 Calculated major oxide data of selected coal seams - Sydney Basin COAL

SEAM		SiO_2 wt%	Al_2O_3 wt%	CaO wt%	MgO wt%	Na_2O wt%	K_2O wt%	Fe_2O_3 wt%	MnO wt%	TiO_2 wt%	P_2O_5 wt%
Phalen Seam/	Roof	30.1	16.2	0.16	0.80	0.24	2.10	10.0	0.009	0.61	0.081
Phalen Colliery:											
Shale	0.00 - 0.15	0.58	0.32	0.71	0.03	0.06	0.01	2.33	0.008	0.01	0.004
Roof	0.15 - 0.30	2.15	1.00	0.76	0.05	0.04	0.08	0.88	0.007	0.05	0.003
	0.30 - 0.45	1.71	0.86	1.08	0.05	0.03	0.07	0.27	0.010	0.04	0.003
	0.45 - 0.60	3.01	1.42	0.13	0.06	0.04	0.12	0.37	0.001	0.08	0.003
	0.60 - 0.75	1.05	0.62	0.24	0.03	0.02	0.03	1.60	0.003	0.02	0.003
	0.75 - 0.83	3.45	2.23	0.32	0.08	0.05	0.22	0.53	0.003	0.06	0.007
	0.83 - 0.93	8.03	4.79	1.13	0.22	0.11	0.55	1.68	0.014	0.14	0.015
	0.93 - 1.08	3.76	2.12	0.70	0.12	0.04	0.19	6.62	0.009	0.08	0.008
	1.08 - 1.23	0.91	0.61	1.52	0.04	0.02	0.03	0.51	0.018	0.02	0.003
	1.23 - 1.38	2.81	1.65	0.77	0.06	0.05	0.11	0.23	0.008	0.07	0.006
	1.38 - 1.53	6.48	2.80	0.12	0.09	0.06	0.24	0.32	0.001	0.21	0.008
	1.53 - 1.68	0.69	0.49	0.60	0.03	0.05	0.02	0.07	0.006	0.02	0.002
	1.68 - 1.83	0.54	0.21	0.48	0.03	0.05	0.01	0.04	0.005	0.01	0.002
	1.83 - 1.98	0.64	0.25	0.20	0.04	0.04	0.01	4.85	0.002	0.01	0.002
	1.98 - 2.13	0.98	0.38	0.80	0.04	0.07	0.02	0.45	0.008	0.02	0.005
	2.13 - 2.28	1.01	0.35	1.50	0.05	0.05	0.02	2.09	0.018	0.02	0.009
	2.28 - 2.48	0.83	0.32	0.73	0.04	0.03	0.01	3.01	0.009	0.02	0.046
	Parting 0.05	18.0	7.52	1.15	0.28	0.11	0.57	12.3	0.012	0.35	0.690
	2.53 - 2.73	0.82	0.44	0.40	0.07	0.05	0.03	8.51	0.012	0.03	0.079
	Floor	56.9	17.3	0.22	1.37	0.34	3.04	5.93	0.031	1.02	0.107
	Average*	2.24	1.14	0.97	0.07	0.07	0.08	2.14	0.011	0.05	0.016

TABLE II.8 Calculated major oxide data of selected coal seams - Sydney Basin COAL

SEAM		SiO_2 wt%	Al_2O_3 wt%	CaO wt%	MgO wt%	Na_2O wt%	K_2O wt%	Fe_2O_3 wt%	MnO wt%	TiO_2 wt%	P_2O_5 wt%
Phalen Seam/		79.3	7.41	0.32	0.45	0.29	0.87	3.27	0.086	0.90	0.070
Phalen Colliery:	Roof	7.71	4.81	0.12	0.37	0.11	0.85	24.8	0.007	0.17	0.064
Sandstone											
Roof	0.00 - 0.15	4.42	2.44	0.14	0.14	0.06	0.29	6.43	0.004	0.13	0.034
	0.15 - 0.30	3.10	1.70	0.08	0.06	0.03	0.15	2.78	0.002	0.11	0.007
	0.30 - 0.45	0.76	0.54	0.07	0.03	0.02	0.02	2.26	0.001	0.02	0.005
	0.45 - 0.60	0.42	0.28	0.14	0.03	0.03	0.01	2.95	0.002	0.01	0.005
	0.60 - 0.75	0.60	0.20	0.30	0.03	0.03	0.01	1.05	0.005	0.01	0.003
	0.75 - 0.90	0.66	0.27	0.30	0.03	0.03	0.01	2.36	0.005	0.01	0.002
	0.90 - 1.05	0.84	0.33	0.32	0.03	0.03	0.01	0.58	0.004	0.02	0.003
	1.05 - 1.20	0.80	0.31	0.45	0.03	0.05	0.01	0.28	0.005	0.02	0.002
	1.20 - 1.35	0.86	0.30	0.30	0.04	0.06	0.01	2.87	0.003	0.02	0.012
	1.35 - 1.45	2.62	1.17	0.32	0.08	0.06	0.10	4.40	0.003	0.06	0.091
	Parting 0.05	21.9	9.62	1.75	0.41	0.16	0.78	10.4	0.012	0.45	0.967
	1.50 - 1.65	1.79	0.88	0.23	0.06	0.04	0.07	4.85	0.003	0.04	0.088
	1.65 - 1.80	11.0	4.78	0.84	0.24	0.10	0.39	9.92	0.009	0.24	0.495
	1.80 - 1.95	11.4	4.98	0.96	0.25	0.10	0.42	9.17	0.013	0.23	0.541
	Floor	54.0	21.0	0.30	1.91	0.51	3.86	5.92	0.026	1.00	0.120
	Average*	3.13	1.45	0.62	0.10	0.08	0.10	4.82	0.008	0.08	0.070

TABLE II.9 Trace element data of selected coal seams - Sydney Basin ASH

SEAM		Ag ppm	As ppm	Au ppb	B ppm	Ba ppm	Be ppm	Bi ppm	Cd ppm	Co ppm	Cr ppm	Cs ppm	Cu ppm	Ga ppm	Ge ppm	Hf ppm	Hg ppb	In ppm	Li ppm
Hub Seam/ Prince Mine: Shale Roof	Roof	<0.5	25.0	<4	70	816	7	0.5	<0.2	23	94	12	51.0	33.7	<10	3	16	<0.5	860
	0.00 - 0.08	<0.5	230	---	50	387	16	0.7	10.0	84	140	6	260	29.1	20	2	32	<0.5	200
	0.08 - 0.23	<0.5	95.0	<60	170	318	55	1.2	2.0	61	140	4	220	97.0	270	5	93	<1	140
	0.23 - 0.38	<0.5	4.7	---	170	204	36	0.7	2.8	24	56	1	190	58.5	240	3	38	<0.5	36
	0.38 - 0.53	<0.5	4.0	---	370	260	23	2.0	<0.2	18	130	5	320	24.2	260	6	48	<0.5	68
	0.53 - 0.68	<0.5	440	<20	190	269	13	2.5	<0.2	51	140	5	240	41.0	50	4	100	<1	58
	0.68 - 0.83	<0.5	12.0	---	540	228	14	1.2	1.2	19	110	4	140	21.2	80	4	49	<0.5	84
	0.83 - 0.98	<0.5	96.0	---	490	321	11	1.1	0.8	37	120	4	130	32.0	50	6	27	<0.5	92
	0.98 - 1.13	<0.5	94.0	---	350	427	13	1.6	<0.2	17	110	9	130	17	40	6	89	<1	---
	1.13 - 1.28	<0.5	600	400	260	288	14	1.2	<0.2	52	120	5	160	46.0	20	6	64	<1	62
	1.28 - 1.43	<0.5	1400	---	460	236	18	0.6	<0.2	16	20	1	150	34	<10	2	120	<1	38
	1.43 - 1.58	<0.5	1500	---	280	275	18	0.4	<0.2	7	26	<1	110	8.0	<10	<1	65	<0.5	25
	1.58 - 1.73	<0.5	1200	---	410	446	20	0.9	<0.2	28	98	5	150	44.3	20	4	46	<0.5	59
	1.73 - 1.88	<0.5	750	<20	280	403	17	1.3	<0.2	21	170	6	120	47.0	40	3	81	<1	86
	1.88 - 2.03	6.0	1300	7	<10	589	14	0.6	6.0	11	111	4	150	19.6	<10	<2	35	<1.0	<1
	2.03 - 2.18	<0.5	840	<60	70	283	16	0.3	<0.5	11	97	7	68.0	14.6	<10	1	19	<0.5	<1
	2.18 - 2.33	<0.5	800	<70	70	352	25	0.4	<0.2	13	60	19	140	26.1	20	2	19	<0.5	110
	2.33 - 2.43	1.5	1700	<80	40	315	31	0.4	4.0	158	120	6	300	29.9	70	1	29	<0.5	36
	Floor	<0.5	37.0	<4	70	800	7	0.5	<0.2	26	72	12	38.0	29.7	10	3	6	<0.5	170
	Average*	---	653	---	250	330	21	1.0	---	34	103	5	171	34.6	71	3	56	---	62
Hub Seam/ Prince Mine: Sandstone Roof	Roof	<0.5	13.0	<4	100	117	2	<0.1	<0.2	13	14	<1	14.0	4.3	<10	<1	6	<0.5	14
	0.00 - 0.15	6.5	670	<40	10	243	86	0.1	8.0	57	97	<2	220	56.3	20	<2	11	<1.0	28
	0.15 - 0.30	<0.5	500	<80	70	238	34	0.4	<0.2	34	34	<1	140	16.7	30	1	30	<0.5	20
	0.30 - 0.45	<0.5	730	---	70	218	16	0.6	<0.2	18	40	<1	230	10.5	<10	1	57	<0.5	24
	0.45 - 0.47	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	0.47 - 0.62	<0.5	160	<40	120	544	13	1.6	<0.2	50	130	16	130	33.8	20	3	19	<0.5	250
	0.62 - 0.77	<0.5	2400	---	260	236	17	1.0	<0.2	35	96	4	170	49.5	20	3	270	<0.5	130
	0.77 - 0.92	<0.5	2400	---	150	234	16	0.6	<0.2	27	66	3	140	30.0	10	2	340	<0.5	74
	0.92 - 1.07	<0.5	800	<40	400	386	14	1.7	<0.2	41	180	12	160	38.0	30	5	76	<1	160
	1.07 - 1.22	<0.5	450	<40	330	410	12	2.0	<0.2	41	150	8	140	50.0	20	10	52	<0.5	220
	1.22 - 1.37	<0.5	2700	---	160	335	14	0.5	<0.2	15	56	2	140	11.1	<10	<1	64	<0.5	28
	1.37 - 1.52	<0.5	1100	<80	160	456	15	0.7	<0.2	25	110	7	110	48.3	<10	2	110	<0.5	72
	Parting 0.01	<0.5	230	---	40	418	7	1.2	<0.2	4	70	15	27.0	24.1	<10	5	<5	<0.5	380
	1.53 - 1.68	<0.5	2200	---	90	665	21	0.6	<0.2	17	54	5	160	22.2	<10	<1	38	<0.5	54
	1.68 - 1.83	<0.5	930	24	80	824	18	0.5	<0.2	23	58	10	150	18.2	10	2	22	<0.5	92
	1.83 - 1.98	<0.5	2100	<40	70	317	35	0.3	0.8	19	76	16	160	44.5	30	2	22	<0.5	80
	Floor	<0.5	7.0	<10	110	719	5	0.2	<0.2	9	76	8	19.0	22.6	10	3	<5	<0.5	130
	Average*	---	1302	---	146	396	24	0.8	---	31	88	7	157	33.0	16	3	83	---	97

TABLE II.9 Trace element data of selected coal seams - Sydney Basin ASH

SEAM		Ag ppm	As ppm	Au ppb	B ppm	Ba ppm	Be ppm	Bi ppm	Cd ppm	Co ppm	Cr ppm	Cs ppm	Cu ppm	Ga ppm	Ge ppm	Hf ppm	Hg ppb	In ppm	Li ppm
Harbour Seam/ Lingan Mine: Shale Roof	Roof	<0.5	15.0	<10	80	756	8	0.7	<0.2	15	110	15	50.0	32.8	<10	3	<5	<0.5	240
	0.00 - 0.15	6.5	550	<40	<10	1130	37	1.0	7.0	78	237	2	210	47.6	<10	1	26	<0.5	76
	0.15 - 0.30	<0.5	1300	---	90	301	16	0.4	<0.2	18	10	---	110	48.0	30	---	77	<0.5	14
	0.30 - 0.45	<0.5	1500	---	80	338	16	0.7	<0.2	20	10	1	140	46.2	<10	2	42	<0.5	10
	0.45 - 0.58	<0.5	18.0	---	470	901	14	2.2	<0.2	70	120	<1	410	49.0	<10	7	33	<0.5	81
	0.58 - 0.63	<0.5	3.6	---	210	509	11	2.5	<0.2	29	94	3	430	37.1	10	7	46	<0.5	100
	0.63 - 0.75	<0.5	2.3	---	260	856	14	2.0	0.8	37	92	3	360	41.0	10	7	65	<0.5	90
	0.75 - 0.90	<0.5	7.7	---	260	454	10	0.8	<0.2	17	38	2	120	22.8	<10	1	46	<0.5	48
	0.90 - 1.05	<0.5	20.0	---	230	746	11	1.2	<0.2	35	88	5	260	42.6	20	5	46	<0.5	150
	1.05 - 1.20	<0.5	17.0	<80	80	596	10	1.5	1.2	13	130	7	190	25.1	<10	4	19	<0.5	400
	1.20 - 1.35	<0.5	2300	---	100	389	16	0.3	<0.2	25	26	2	91.0	40.0	<10	2	59	<0.5	22
	1.35 - 1.50	<0.5	430	---	420	668	23	0.9	<0.2	75	90	2	330	34.0	20	3	33	<0.5	68
	1.50 - 1.65	<0.5	1300	---	90	430	21	1.0	<0.2	28	92	12	290	42.8	<10	6	42	<0.5	190
	1.65 - 1.80	<0.5	450	---	130	539	82	0.6	<0.2	32	120	11	220	95.0	250	4	66	<1	59
	Floor	<0.5	13.0	<10	80	859	8	0.4	<0.2	26	120	12	53.0	27.3	<10	3	<5	<0.5	200
	Average*	---	662	---	179	603	22	1.1	---	37	88	4	228	44.3	30	4	46	---	102
Harbour Seam/ Lingan Mine: Sandstone Roof	Roof	<0.5	3.0	<40	80	450	7	0.1	<0.2	24	90	3	42.0	20.8	<10	2	22	<0.5	58
	0.00 - 0.15	<0.5	160	2	60	436	86	0.4	<0.2	48	50	1	92.0	131	420	1	140	<0.5	26
	0.15 - 0.30	<0.5	240	<40	50	402	20	0.3	<0.2	17	16	<2	86.0	19.0	20	<2	12	<1.0	16
	0.30 - 0.45	<0.5	500	<40	40	407	18	0.3	<0.2	10	8	<1	53.0	6.8	<10	<1	85	<0.5	14
	0.45 - 0.55	<0.5	560	<20	200	486	19	1.3	<0.2	32	64	<1	190	58.0	20	3	54	<1	8
	0.55 - 0.60	<0.5	1800	---	50	393	12	0.6	<0.2	8	26	<1	110	4.7	<10	2	22	<0.5	8
	0.60 - 0.75	<0.5	450	<350	160	449	16	0.7	<0.2	18	18	1	130	41.5	<10	2	22	<0.5	14
	0.75 - 0.90	<0.5	930	---	130	483	12	0.5	<0.2	11	22	<1	89.0	6.2	10	<1	55	<0.5	14
	0.90 - 1.05	<0.5	45.0	<40	130	446	16	0.5	<0.2	16	76	<4	19.0	17.5	10	<4	30	<1.9	12
	1.05 - 1.20	<0.5	410	<80	110	481	13	0.4	2.4	35	74	1	150	16.7	<10	1	22	<0.5	140
	1.20 - 1.35	<0.5	1000	<40	140	390	21	0.3	<0.2	31	30	1	100	74.0	20	1	34	<1	28
	1.35 - 1.50	<0.5	1100	<150	140	475	22	0.4	<0.2	36	57	<1	120	70.0	<10	1	---	<1	16
	1.50 - 1.65	<0.5	930	<80	80	475	19	0.7	1.6	22	66	13	230	18.6	<10	2	19	<0.5	82
	Average*	---	615	---	108	445	24	0.5	---	24	43	2	112	40.1	48	1	42	---	34

TABLE II.9 Trace element data of selected coal seams - Sydney Basin ASH

SEAM		Ag ppm	As ppm	Au ppb	B ppm	Ba ppm	Be ppm	Bi ppm	Cd ppm	Co ppm	Cr ppm	Cs ppm	Cu ppm	Ga ppm	Ge ppm	Hf ppm	Hg ppb	In ppm	Li ppm
Phalen Seam/ Phalen Colliery:	Roof	<0.5	190	---	70	936	8	0.8	<0.2	58	130	11	130	25.6	<10	2	6	<0.5	240
Shale	0.00 - 0.15	<0.5	730	---	160	17300	79	0.2	<0.2	20	12	2	51.0	152	1200	1	11	<1	31
Roof	0.15 - 0.30	<0.5	170	---	130	375	20	0.5	<0.2	20	86	---	100	33.6	20	---	25	<0.5	92
	0.30 - 0.45	<0.5	120	<80	160	201	6	0.5	<0.2	23	110	7	85.0	24.0	10	4	13	<1	82
	0.45 - 0.60	<0.5	20.0	<80	130	456	8	0.7	<0.2	37	130	15	100	36.0	<10	7	25	<0.5	160
	0.60 - 0.75	<0.5	790	---	150	290	15	0.5	<0.2	31	42	5	160	42	30	3	35	<1	50
	0.75 - 0.83	<0.5	170	---	130	487	7	0.6	<0.2	17	160	17	110	46.3	<10	3	26	<0.5	260
	0.83 - 0.93	<0.5	310	---	110	460	6	0.7	<0.2	15	130	12	77.0	34.6	10	2	13	<0.5	250
	0.93 - 1.08	<0.5	900	---	90	258	11	0.4	<0.2	<1	58	5	80.0	20.7	<10	1	37	<0.5	150
	1.08 - 1.23	<0.5	60.0	---	120	174	5	0.3	<0.2	18	64	3	53.0	16.4	<10	2	22	<0.5	48
	1.23 - 1.38	<0.5	17.0	---	130	296	6	0.7	<0.2	21	110	11	87.0	29.3	<10	4	19	<0.5	84
	1.38 - 1.53	<0.5	5.0	---	110	456	4	0.9	<0.2	11	140	15	83.0	29.9	<10	6	26	<0.5	190
	1.53 - 1.68	<0.5	190	---	220	138	4	0.7	<0.2	24	80	4	130	27.2	<10	2	40	<0.5	94
	1.68 - 1.83	<0.5	120	---	360	198	4	0.7	<0.2	30	58	<1	150	11.0	<10	2	33	<0.5	80
	1.83 - 1.98	<0.5	2200	700	80	223	18	0.2	<0.2	13	<2	<1	71.0	40.8	<10	1	16	<0.5	20
	1.98 - 2.13	<0.5	570	---	180	161	6	0.7	<0.2	14	52	2	130	15	10	3	20	<1	40
	2.13 - 2.28	<0.5	900	---	90	136	8	0.3	<0.2	11	34	2	78.0	4.8	<10	<1	48	<0.5	17
	2.28 - 2.48	<0.5	2200	---	100	196	20	0.3	<0.2	11	32	<1	120	13.0	10	<1	51	<0.5	20
	Parting 0.05	<0.5	500	---	80	357	11	0.8	<0.2	45	90	6	110	12.9	<10	2	13	<0.5	78
	2.53 - 2.73	<0.5	1800	<40	50	809	39	0.3	<0.2	41	28	1	130	82.0	230	1	67	<1	12
	Floor	<0.5	69.0	---	90	603	5	0.3	<0.2	30	100	8	45.0	21.2	<10	4	<5	<0.5	60
	Average*	---	673	---	135	1263	16	0.5	---	21	70	5	101	36.9	92	2	30	---	85

TABLE II.9 Trace element data of selected coal seams - Sydney Basin ASH

SEAM		Ag ppm	As ppm	Au ppb	B ppm	Ba ppm	Be ppm	Bi ppm	Cd ppm	Co ppm	Cr ppm	Cs ppm	Cu ppm	Ga ppm	Ge ppm	Hf ppm	Hg ppb	In ppm	Li ppm
Phalen Seam/		<0.5	25.0	3	70	392	2	<0.1	<0.2	18	54	1	22.0	8.0	10	22	<5	<1	18
Phalen Colliery:	Roof	<0.5	850	<7	80	535	21	0.6	<0.2	154	110	6	250	70.0	<10	2	<5	<1	70
Sandstone																			
Roof	0.00 - 0.15	<0.5	450	<10	100	381	57	0.4	<0.2	16	72	9	51.0	75.8	140	4	17	<0.5	94
	0.15 - 0.30	<0.5	300	---	120	608	25	0.7	<0.2	22	110	12	88.0	44.5	30	7	17	<0.5	120
	0.30 - 0.45	<0.5	450	---	160	5840	17	0.4	<0.2	18	46	2	72.0	41.0	20	2	17	<0.5	74
	0.45 - 0.60	<0.5	600	---	190	1970	17	0.2	<0.2	15	4	<1	62.0	42.0	<10	2	20	<0.5	34
	0.60 - 0.75	<0.5	280	---	260	2100	11	0.6	<0.2	29	22	1	100	37	10	2	11	<1	46
	0.75 - 0.90	<0.5	1600	---	180	2460	16	0.4	<0.2	17	26	1	84.0	40.1	10	2	41	<0.5	36
	0.90 - 1.05	<0.5	220	---	290	4370	8	1.0	<0.2	23	80	1	150	27	10	4	6	<1	61
	1.05 - 1.20	<0.5	230	---	240	1060	5	0.7	<0.2	10	70	2	140	10.2	10	4	25	<0.5	64
	1.20 - 1.35	<0.5	1900	---	120	622	15	0.8	<0.2	13	24	<1	140	42.0	20	1	32	<0.5	24
	1.35 - 1.45	<0.5	1200	40	120	749	13	0.6	<0.2	23	54	5	110	43.8	<10	3	20	<0.5	88
	Parting 0.05	<0.5	500	<7	100	324	9	0.9	<0.2	38	100	6	97.0	28.0	10	5	20	<1	160
	1.50 - 1.65	<0.5	1500	<40	120	1240	19	0.5	<0.2	20	48	4.0	170	48.5	10	3	20	<0.5	52
	1.65 - 1.80	<0.5	1100	<7	90	540	12	0.9	<0.2	35	90	4	120	40.0	<10	3	10	<1	120
	1.80 - 1.95	<0.5	550	<10	90	672	15	0.8	<0.2	38	94	6	100	40.0	90	4	<5	<1	130
	Floor	<0.5	60.0	<4	110	666	5	0.3	<0.2	42	120	9	35.0	28.0	<10	4	<5	<1	84
	Average*	---	783	---	155	1661	18	0.6	---	22	60	4	106	40.7	29	3	18	---	77

TABLE II.9 Trace element data of selected coal seams - Sydney Basin ASH

SEAM		Mo ppm	Nb ppm	Ni ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn ppm	Sr ppm	Ta ppm	Th ppm	Tl ppm	U ppm	V ppm	W ppm	Y ppm	Zn ppm	Zr ppm
Hub Seam/	Roof	2	21	81	88	164	2.2	23	3.5	6	799	2	20.2	1.0	5.3	180	3	23	75.0	186
Prince Mine:																				
Shale	0.00 - 0.08	13	12	410	830	115	23.0	26	0.7	16	102	1	16.5	11.8	5.6	400	<1	27	2300	95
Roof	0.08 - 0.23	35	26	160	340	59	19.0	26	<0.5	450	244	<1	15.0	4.3	3.8	280	8	66	1500	225
	0.23 - 0.38	11	14	99	370	19	5.5	9	<0.5	565	129	<1	7.5	1.5	2.1	84	13	37	1300	107
	0.38 - 0.53	13	28	110	160	85	0.5	11	<0.5	605	459	1	16.0	2.2	5.4	220	34	64	2100	209
	0.53 - 0.68	80	20	130	240	40	2.4	20	<0.5	280	202	1	19.0	9.7	4.8	230	9	44	1200	214
	0.68 - 0.83	30	23	120	210	46	1.7	8	<0.5	431	718	<1	12.0	1.9	4.2	140	23	91	2700	158
	0.83 - 0.98	52	26	120	210	54	0.5	13	1.5	512	675	<1	14.0	1.5	4.2	140	12	84	1800	192
	0.98 - 1.13	15	23	110	260	74	1.5	8	<0.5	324	190	1	13.0	3.7	4.0	160	4	20	1200	193
	1.13 - 1.28	54	20	120	480	32	2.2	14	<0.5	270	157	1	14.0	11.0	4.2	140	4	32	520	287
	1.28 - 1.43	60	10	52	840	5	7.8	4	<0.5	634	352	<1	4.2	25.6	1.6	72	4	23	1300	<10
	1.43 - 1.58	97	5	45	530	14	0.3	2	<0.5	219	102	<1	4.5	37.3	1.7	64	4	19	690	23
	1.58 - 1.73	160	13	150	430	47	3.9	12	<0.5	783	371	<1	9.6	15.1	4.1	120	9	22	870	128
	1.73 - 1.88	109	16	110	420	57	4.4	24	<0.5	180	263	1	17.0	9.4	4.0	230	4	59	440	158
	1.88 - 2.03	99	13	94	380	86	12.0	10	1.7	41	900	<2	15.4	20.9	4.4	220	6	30	160	135
	2.03 - 2.18	61	7	31	380	54	6.7	9	0.2	43	72	1	8.4	14.6	1.9	140	6	34	190	48
	2.18 - 2.33	37	58	39	320	140	2.4	12	0.2	28	66	1	14.0	11.2	3.1	140	6	46	450	119
	2.33 - 2.43	36	8	580	810	57	80.0	19	0.3	30	90	<1	12.2	15.4	4.1	410	<1	37	1300	48
	Floor	1	17	58	48	207	2.0	19	0.2	5	200	2	15.6	1.2	4.1	190	2	12	65.0	159
	Average*	58	19	135	411	57	9.2	13	---	322	305	---	12.4	11.6	3.7	181	9	43	1137	139
Hub Seam/	Roof	1	2	36	20	33	1.0	2	0.2	6	25	<1	3.0	0.2	0.9	24	1	3	17.0	194
Prince Mine:																				
Sandstone	0.00 - 0.15	17	3	200	980	12	17.0	14	<0.5	30	54	<2	3.2	17.1	1.5	160	4	36	85.0	10
Roof	0.15 - 0.30	14	8	74	720	20	2.0	7	0.4	62	126	1	8.4	29.7	2.0	90	5	17	90.0	109
	0.30 - 0.45	16	6	77	700	9	1.2	7	<0.5	---	140	<1	8.2	24.3	2.3	86	11	35	190	32
	0.45 - 0.47	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	0.47 - 0.62	17	55	150	140	116	4.2	17	2.2	11	213	2	29.8	4.9	8.4	300	4	24	86.0	171
	0.62 - 0.77	25	44	130	320	59	1.8	19	<0.5	483	237	<1	16.0	18.5	4.8	190	15	45	320	62
	0.77 - 0.92	30	16	68	420	40	1.0	12	<0.5	407	111	<1	11.0	26.2	3.2	130	6	<10	190	44
	0.92 - 1.07	67	34	140	140	151	0.4	26	<0.5	510	527	1	15.0	3.8	4.1	250	4	81	310	272
	1.07 - 1.22	103	70	130	200	65	0.8	30	<0.5	637	492	3	22.0	16.5	7.5	210	9	64	300	455
	1.22 - 1.37	227	8	91	320	23	4.0	6	1.0	---	191	<1	6.8	29.1	2.2	80	8	34	290	35
	1.37 - 1.52	125	27	97	290	101	8.0	22	<0.5	211	301	<1	14.0	9.6	3.9	150	8	29	240	55
	Parting 0.01	20	15	34	48	90	0.6	13	0.4	4	221	3	24.4	0.9	5.4	98	5	16	26.0	382
	1.53 - 1.68	117	8	62	340	58	9.6	12	1.6	52	451	1	11.6	32.7	3.6	250	10	36	120	40
	1.68 - 1.83	83	11	90	280	95	4.0	9	0.5	26	678	1	13.4	19.0	3.1	210	7	29	150	94
	1.83 - 1.98	35	14	80	240	42	20.0	13	0.5	32	87	1	14.3	27.3	3.5	240	9	55	130	121
	Floor	1	20	32	16	158	0.6	14	0.2	10	144	2	12.2	0.7	3.4	140	2	9	42.0	285
	Average*	66	23	107	393	61	5.9	15	---	212	275	---	13.4	19.8	3.9	181	8	37	197	115

TABLE II.9 Trace element data of selected coal seams - Sydney Basin ASH

SEAM		Mo ppm	Nb ppm	Ni ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn ppm	Sr ppm	Ta ppm	Th ppm	Tl ppm	U ppm	V ppm	W ppm	Y ppm	Zn ppm	Zr ppm
Harbour Seam/ Lingan Mine: Shale Roof	Roof	4	21	79	52	208	1.0	24	0.9	13	310	2	18.4	1.4	4.7	190	2	19	70.0	163
	0.00 - 0.15	22	9	200	20	51	16.0	16	2.4	37	1090	1	16.8	29.9	6.2	380	2	81	110	61
	0.15 - 0.30	3	31	23	4	<10	1.3	3	<0.5	171	50	---	---	23.8	---	48	---	<10	48.0	45
	0.30 - 0.45	7	22	24	16	46	0.8	4	<0.5	700	62	<1	6.9	20.3	1.8	54	9	13	41.0	48
	0.45 - 0.58	95	22	170	50	19	0.9	9	2.3	878	569	1	11.0	2.5	4.0	140	28	48	140	196
	0.58 - 0.63	47	23	86	58	28	0.5	19	<0.5	564	235	<1	18.0	2.0	5.5	130	4	47	61.0	297
	0.63 - 0.75	35	23	84	52	21	0.5	18	<0.5	506	413	3	15.0	0.7	5.2	160	8	28	78.0	256
	0.75 - 0.90	46	11	70	8	11	0.7	2	<0.5	286	264	<1	4.3	2.7	1.6	66	8	13	60.0	65
	0.90 - 1.05	53	19	68	28	69	0.3	14	2.3	294	415	2	13.0	2.1	3.0	120	6	39	76.0	205
	1.05 - 1.20	22	30	50	56	80	0.8	20	1.5	16	423	3	24.4	1.4	5.1	190	3	27	42.0	321
	1.20 - 1.35	59	8	57	<2	7	3.5	5	1.1	258	110	<1	4.9	30.3	1.3	60	7	9	96.0	59
	1.35 - 1.50	307	17	56	12	15	3.1	9	0.8	452	560	<1	6.9	2.4	2.2	110	48	110	230	70
	1.50 - 1.65	70	19	65	20	69	1.0	15	1.9	82	156	1	13.0	16.2	3.5	140	17	63	93.0	261
	1.65 - 1.80	60	18	80	22	46	62.0	26	<0.5	120	205	<1	15.0	11.5	4.0	250	18	108	170	116
	Floor	2	16	86	48	224	2.8	19	0.5	11	281	2	16.2	1.2	4.0	240	2	13	130	119
	Average*	64	19	78	24	37	7.6	12	---	310	355	---	12.1	12.1	3.5	144	14	46	97.3	144
Harbour Seam/ Lingan Mine: Sandstone Roof	Roof	1	18	48	16	105	0.6	16	0.4	25	112	2	11.8	0.7	2.8	200	<1	11	91.0	363
	0.00 - 0.15	15	9	66	20	63	0.9	12	0.3	54	101	1	7.2	37.9	2.1	100	3	55	87.0	112
	0.15 - 0.30	19	8	26	12	73	0.8	4	2.1	81	97	<2	5.2	18.7	1.3	70	9	20	31.0	34
	0.30 - 0.45	20	4	22	8	21	1.0	6	3.3	51	90	<1	2.6	1.8	0.6	46	6	11	22.0	16
	0.45 - 0.55	25	14	51	12	5	0.8	6	<0.5	260	154	1	7.8	1.5	2.7	110	8	26	32.0	97
	0.55 - 0.60	20	10	30	24	16	0.6	4	0.8	---	72	<1	11.6	0.4	2.2	50	1	18	20.0	214
	0.60 - 0.75	<1	24	23	16	36	0.8	6	<0.5	204	121	<1	6.8	1.7	1.9	62	4	<10	41.0	72
	0.75 - 0.90	32	6	33	8	15	0.8	4	0.6	---	121	<1	4.4	1.6	1.3	44	3	21	59.0	26
	0.90 - 1.05	49	38	3	8	17	0.3	6	0.5	57	152	<4	5.4	2.4	1.3	110	<4	---	10.0	20
	1.05 - 1.20	13	51	92	40	43	1.6	13	3.0	17	114	1	8.2	28.8	1.9	190	4	24	43.0	203
	1.20 - 1.35	64	9	19	<2	3	1.0	<1	<0.5	230	80	<1	2.7	8.7	0.5	66	3	27	94.0	49
	1.35 - 1.50	102	6	25	<2	9	1.4	<1	<0.5	260	95	<1	3.3	19.6	0.9	54	12	42	63.0	48
	1.50 - 1.65	89	17	44	20	79	2.2	12	1.0	19	103	2	12.5	16.2	3.0	140	14	50	240	232
	Average*	39	17	36	14	34	1.1	6	---	117	109	---	6.2	12.7	1.6	89	6	25	65.9	87

TABLE II.9 Trace element data of selected coal seams - Sydney Basin ASH

SEAM		Mo ppm	Nb ppm	Ni ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn ppm	Sr ppm	Ta ppm	Th ppm	Tl ppm	U ppm	V ppm	W ppm	Y ppm	Zn ppm	Zr ppm
Phalen Seam/	Roof	6	13	280	160	134	9.2	20	<0.5	---	328	<1	17.9	4.0	4.5	210	2	24	290	140
Phalen Colliery:																				
Shale	0.00 - 0.15	25	7	18	40	6	120	16	<0.5	312	647	<1	3.5	11.3	1.9	54	17	85	94.0	<10
Roof	0.15 - 0.30	62	34	54	28	81	2.8	16	<0.5	147	595	---	---	9.3	---	120	---	45	92.0	172
	0.30 - 0.45	38	23	44	12	105	1.4	14	<0.5	110	854	1	11.0	1.7	2.7	130	6	28	78.0	119
	0.45 - 0.60	53	35	58	20	198	0.8	29	<0.5	102	803	1	19.0	1.9	4.5	200	4	62	96.0	272
	0.60 - 0.75	63	10	88	46	39	6.6	10	1.1	174	796	<1	8.3	12.5	2.4	110	4	41	98.0	61
	0.75 - 0.83	25	16	77	60	173	1.8	29	<0.5	---	744	<1	20.8	3.9	6.9	220	2	44	110	177
	0.83 - 0.93	18	16	61	48	149	1.6	33	<0.5	---	416	<1	16.9	4.2	4.8	180	2	43	73.0	207
	0.93 - 1.08	95	8	56	44	58	1.6	14	1.0	---	169	<1	9.2	10.5	2.2	110	2	27	50.0	81
	1.08 - 1.23	42	8	62	10	31	1.6	13	2.7	---	747	<1	7.6	1.6	2.1	86	3	59	78.0	51
	1.23 - 1.38	23	22	44	20	120	1.2	28	<0.5	---	846	2	18.1	0.9	4.6	190	2	51	81.0	175
	1.38 - 1.53	15	33	30	40	139	0.2	24	<0.5	---	601	3	29.6	0.7	6.4	190	3	30	59.0	350
	1.53 - 1.68	103	16	70	20	34	1.3	12	1.9	166	2140	<1	8.2	1.8	1.8	100	6	30	200	68
	1.68 - 1.83	120	14	77	<2	41	2.9	8	1.2	245	2660	<1	4.9	0.6	1.8	68	3	40	290	92
	1.83 - 1.98	110	29	18	12	36	1.6	<1	<0.5	186	273	<1	3.0	16.9	1.2	44	<2	<10	150	<10
	1.98 - 2.13	107	14	27	28	20	2.0	7	1.8	134	1310	<1	6.5	3.1	2.4	76	4	22	190	44
	2.13 - 2.28	115	5	33	<2	14	1.6	5	<0.5	---	614	<1	4.8	1.9	1.8	54	3	17	120	27
	2.28 - 2.48	184	5	32	8	11	2.4	6	1.5	---	521	<1	3.8	4.6	1.6	64	5	20	200	20
	Parting 0.05	79	10	180	24	76	1.2	12	<0.5	---	398	<1	14.6	10.2	4.2	120	1	38	200	157
	2.53 - 2.73	280	7	34	<2	6	18.0	1	<0.5	190	204	<1	3.0	35.7	33.3	100	<1	52	170	52
	Floor	13	16	80	76	163	3.2	19	<0.5	---	250	1	13.3	1.2	16.7	130	2	16	270	253
	Average"	89	16	51	23	65	9.8	14	---	177	801	---	9.5	7.8	5.2	112	4	39	127	106

TABLE II.9 Trace element data of selected coal seams - Sydney Basin ASH

SEAM		Mo ppm	Nb ppm	Ni ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn ppm	Sr ppm	Ta ppm	Th ppm	Tl ppm	U ppm	V ppm	W ppm	Y ppm	Zn ppm	Zr ppm
Phalen Seam/		3	23	26	12	49	0.8	5	<0.5	82	111	1	10.0	0.2	3.5	62	<1	10	22.0	906
Phalen Colliery:	Roof	49	19	290	480	47	10.0	10	<0.5	38	101	1	11.0	9.7	4.5	490	<2	17	55.0	81
Sandstone																				
Roof	0.00 - 0.15	<1	36	37	64	145	1.8	22	<0.5	192	189	1	12.0	17.1	3.6	180	4	29	59.0	167
	0.15 - 0.30	6	41	36	36	115	0.6	24	<0.5	253	311	1	22.0	14.9	5.5	200	10	32	65.0	244
	0.30 - 0.45	17	27	33	12	41	0.7	9	<0.5	547	530	<1	8.4	20.8	2.3	110	16	<10	69.0	56
	0.45 - 0.60	1	37	14	<2	29	0.8	2	<0.5	463	451	<1	4.1	18.8	1.3	54	<2	<10	61.0	<10
	0.60 - 0.75	49	9	320	14	13	1.5	3	0.6	561	1460	<1	4.3	9.6	1.5	58	3	17	150	<10
	0.75 - 0.90	58	33	41	<2	31	2.0	3	<0.5	380	573	<1	5.1	16.0	1.8	94	<3		190	<10
	0.90 - 1.05	136	15	65	<2	16	5.9	10	1.1	624	1610	1	9.7	5.1	3.7	130	4	25	240	84
	1.05 - 1.20	62	13	59	<2	25	3.2	5	2.2	304	2050	1	7.2	1.5	2.7	92	4	31	260	53
	1.20 - 1.35	294	24	31	20	29	2.0	2	<0.5	367	556	<1	5.4	12.3	2.3	56	4	<10	140	24
	1.35 - 1.45	191	37	50	20	65	1.4	9	<0.5	195	410	1	11.0	11.1	3.4	100	4	13	170	92
	Parting 0.05	76	14	92	12	61	0.6	11	<0.5	78	366	1	16.0	7.2	3.7	130	<1	33	100	170
	1.50 - 1.65	197	40	40	<2	51	1.4	11	<0.5	211	360	<1	8.6	23.1	5.0	110	5	<10	250	40
	1.65 - 1.80	102	15	78	20	42	4.1	11	<0.5	150	263	<1	12.0	24.0	3.6	120	2	25	100	135
	1.80 - 1.95	93	16	81	20	48	10.0	12	<0.5	140	307	1	14.0	11.9	11.6	120	3	45	150	127
	Floor	21	27	82	28	202	3.4	21	<0.5	78	241	1	12.0	1.7	6.9	170	1	20	250	164
	Average*	90	26	69	17	51	3	10	---	323	669	---	9.9	14.4	3.8	112	5	19	143	85

TABLE II.10 Calculated trace element data of selected coal seams - Svdnev Basin COAL

SEAM		As ppm	B ppm	Ba ppm	Be ppm	Bi ppm	Co ppm	Cr ppm	Cs ppm	Cu ppm	Ga ppm	Ge ppm	Hf ppm	Hg ppb	Li ppm
Hub Seam/	Roof	21.6	61	707	6.1	0.43	20	81	10	44.2	29.2	4.3	2.6	14	745
Prince Mine:															
Shale	0.00 - 0.08	66.4	14	112	4.6	0.20	24	40	1.7	75.1	8.4	5.8	0.6	9.2	58
Roof	0.08 - 0.23	3.2	5.7	10.7	1.9	0.04	2.1	4.7	0.1	7.4	3.3	9.1	0.2	3.1	4.7
	0.23 - 0.38	0.1	5.1	6.1	1.1	0.02	0.7	1.7	0.0	5.7	1.7	7.1	0.1	1.1	1.1
	0.38 - 0.53	0.1	7.9	5.5	0.5	0.04	0.4	2.8	0.1	6.8	0.5	5.5	0.1	1.0	1.4
	0.53 - 0.68	19.4	8.4	11.9	0.6	0.11	2.3	6.2	0.2	10.6	1.8	2.2	0.2	4.4	2.6
	0.68 - 0.83	0.2	7.7	3.2	0.2	0.02	0.3	1.6	0.1	2.0	0.3	1.1	0.1	0.7	1.2
	0.83 - 0.98	1.6	8.0	5.3	0.2	0.02	0.6	2.0	0.1	2.1	0.5	0.8	0.1	0.4	1.5
	0.98 - 1.13	2.3	8.7	10.6	0.3	0.04	0.4	2.7	0.2	3.2	0.4	1.0	0.1	2.2	---
	1.13 - 1.28	27.9	12	13.4	0.7	0.06	2.4	5.6	0.2	7.4	2.1	0.9	0.3	3.0	2.9
	1.28 - 1.43	40.3	13	6.8	0.5	0.02	0.5	0.6	0.0	4.3	1.0	0.1	0.1	3.5	1.1
	1.43 - 1.58	68.1	13	12.5	0.8	0.02	0.3	1.2	0.0	5.0	0.4	0.2	0.0	2.9	1.1
	1.58 - 1.73	25.9	8.8	9.6	0.4	0.02	0.6	2.1	0.1	3.2	1.0	0.4	0.1	1.0	1.3
	1.73 - 1.88	35.5	13	19.1	0.8	0.06	1.0	8.0	0.3	5.7	2.2	1.9	0.1	3.8	4.1
	1.88 - 2.03	154	0.6	69.7	1.7	0.07	1.3	13	0.5	17.8	2.3	0.6	0.1	4.1	0.1
	2.03 - 2.18	94.0	7.8	31.7	1.8	0.03	1.2	11	0.8	7.6	1.6	0.6	0.1	2.1	0.1
	2.18 - 2.33	122	11	53.5	3.8	0.06	2.0	9.1	2.9	21.3	4.0	3.0	0.3	2.9	17
	2.33 - 2.43	387	9.1	71.7	7.1	0.09	36	27	1.4	68.3	6.8	15.9	0.2	6.6	8.2
	Floor	32.1	61	695	6.1	0.43	23	63	10	33.0	25.8	8.7	2.6	5.2	148
	Average"	59.0	8.9	24.9	1.5	0.05	3.7	7.4	0.5	13.2	2.1	3.1	0.2	2.9	5.2
Hub Seam/	Roof	12.5	96	113	1.9	0.05	13	13	0.5	13.5	4.1	4.8	0.5	5.8	13
Prince Mine:															
Sandstone	0.00 - 0.15	94.4	1.4	34.2	12	0.01	8.0	14	0.1	31.0	7.9	2.8	0.1	1.5	3.9
Roof	0.15 - 0.30	36.3	5.1	17.3	2.5	0.03	2.5	2.5	0.0	10.2	1.2	2.2	0.1	2.2	1.5
	0.30 - 0.45	40.0	3.8	11.9	0.9	0.03	1.0	2.2	0.0	12.6	0.6	0.3	0.1	3.1	1.3
	0.45 - 0.47	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	0.47 - 0.62	25.1	19	85.4	2.0	0.25	7.9	20	2.5	20.4	5.3	3.1	0.5	3.0	39
	0.62 - 0.77	56.3	6.1	5.5	0.4	0.02	0.8	2.3	0.1	4.0	1.2	0.5	0.1	6.3	3.0
	0.77 - 0.92	126	7.9	12.3	0.8	0.03	1.4	3.5	0.2	7.3	1.6	0.5	0.1	18	3.9
	0.92 - 1.07	17.7	8.8	8.5	0.3	0.04	0.9	4.0	0.3	3.5	0.8	0.7	0.1	1.7	3.5
	1.07 - 1.22	10.5	7.7	9.6	0.3	0.05	1.0	3.5	0.2	3.3	1.2	0.5	0.2	1.2	5.1
	1.22 - 1.37	97.0	5.7	12.0	0.5	0.02	0.5	2.0	0.1	5.0	0.4	0.2	0.0	2.3	1.0
	1.37 - 1.52	52.6	7.6	21.8	0.7	0.03	1.2	5.3	0.3	5.3	2.3	0.2	0.1	5.3	3.4
	Parting 0.01	159	28	289	4.8	0.83	2.8	48	10	18.7	16.7	3.5	3.5	1.7	263
	1.53 - 1.68	231	9.5	69.9	2.2	0.06	1.8	5.7	0.5	16.8	2.3	0.5	0.1	4.0	5.7
	1.68 - 1.83	114	9.8	101	2.2	0.06	2.8	7.1	1.2	18.4	2.2	1.2	0.2	2.7	11
	1.83 - 1.98	274	9.1	41.3	4.6	0.04	2.5	9.9	2.1	20.8	5.8	3.9	0.3	2.9	10
	Floor	6.5	103	670	4.7	0.19	8.4	71	7.5	17.7	21.1	9.3	2.8	2.3	121
	Average'	92.7	8.0	36.3	2.4	0.06	2.6	6.8	0.7	12.5	2.7	1.3	0.2	4.1	9.5

TABLE II.10 **Calculated trace element data of selected coal seams - Sydney Basin COAL**

SEAM		As ppm	B ppm	Ba ppm	Be ppm	Bi ppm	Co ppm	Cr ppm	Cs ppm	Cu ppm	Ga ppm	Ge ppm	Hf ppm	Hg ppb	Li ppm
Harbour Seam/ Lingan Mine: Shale Roof	Roof	13.2	70	666	7.0	0.62	13	97	13	44.0	28.9	4.4	2.6	2.2	211
	0.00 - 0.15	61.4	0.6	126	4.1	0.11	8.7	26	0.2	23.4	5.3	0.6	0.1	2.9	8.5
	0.15 - 0.30	49.8	3.4	11.5	0.6	0.02	0.7	0.4	---	4.2	1.8	1.1	---	2.9	0.5
	0.30 - 0.45	50.5	2.7	11.4	0.5	0.02	0.7	0.3	0.0	4.7	1.6	0.2	0.1	1.4	0.3
	0.45 - 0.58	0.2	4.4	8.5	0.1	0.02	0.7	1.1	0.0	3.9	0.5	0.0	0.1	0.3	0.8
	0.58 - 0.63	0.1	4.2	10.1	0.2	0.05	0.6	1.9	0.1	8.6	0.7	0.2	0.1	0.9	2.0
	0.63 - 0.75	0.0	4.0	13.2	0.2	0.03	0.6	1.4	0.0	5.5	0.6	0.2	0.1	1.0	1.4
	0.75 - 0.90	0.2	5.2	9.1	0.2	0.02	0.3	0.8	0.0	2.4	0.5	0.1	0.0	0.9	1.0
	0.90 - 1.05	0.4	4.9	15.9	0.2	0.03	0.7	1.9	0.1	5.5	0.9	0.4	0.1	1.0	3.2
	1.05 - 1.20	1.6	7.5	55.8	0.9	0.14	1.2	12	0.7	17.8	2.4	0.5	0.4	1.8	37
	1.20 - 1.35	79.9	3.5	13.5	0.6	0.01	0.9	0.9	0.1	3.2	1.4	0.2	0.1	2.0	0.8
	1.35 - 1.50	4.5	4.4	6.9	0.2	0.01	0.8	0.9	0.0	3.4	0.4	0.2	0.0	0.3	0.7
	1.50 - 1.65	49.8	3.4	16.5	0.8	0.04	1.1	3.5	0.5	11.1	1.6	0.2	0.2	1.6	7.3
	1.65 - 1.80	22.2	6.4	26.6	4.0	0.03	1.6	5.9	0.5	10.9	4.7	12.3	0.2	3.3	2.9
	Floor	11.0	67	724	6.7	0.34	22	101	10	44.7	23.0	4.2	2.5	2.1	169
	Average"	27.0	4.2	26.8	1.1	0.04	1.5	4.8	0.2	8.2	1.8	1.3	0.1	1.6	5.5
Harbour Seam/ Lingan Mine: Sandstone Roof	Roof	2.4	64	358	5.6	0.08	19	72	2.4	33.4	16.6	4.0	1.6	18	46
	0.00 - 0.15	14.1	5.3	38.3	7.6	0.04	4.2	4.4	0.1	8.1	11.5	36.9	0.1	12	2.3
	0.15 - 0.30	12.0	2.5	20.1	1.0	0.01	0.8	0.8	0.0	4.3	0.9	1.0	0.0	0.6	0.8
	0.30 - 0.45	26.9	2.2	21.9	1.0	0.02	0.5	0.4	0.0	2.9	0.4	0.3	0.0	4.6	0.8
	0.45 - 0.55	23.3	8.3	20.2	0.8	0.05	1.3	2.7	0.0	7.9	2.4	0.8	0.1	2.2	0.3
	0.55 - 0.60	123	3.4	26.9	0.8	0.04	0.5	1.8	0.0	7.5	0.3	0.3	0.1	1.5	0.5
	0.60 - 0.75	19.2	6.8	19.2	0.7	0.03	0.8	0.8	0.0	5.6	1.8	0.2	0.1	0.9	0.6
	0.75 - 0.90	40.3	5.6	20.9	0.5	0.02	0.5	1.0	0.0	3.9	0.3	0.4	0.0	2.4	0.6
	0.90 - 1.05	1.6	4.6	15.8	0.6	0.02	0.6	2.7	0.1	0.7	0.6	0.4	0.1	1.1	0.4
	1.05 - 1.20	36.4	9.8	42.7	1.2	0.04	3.1	6.6	0.1	13.3	1.5	0.4	0.1	2.0	12
	1.20 - 1.35	46.4	6.5	18.1	1.0	0.01	1.4	1.4	0.0	4.6	3.4	0.9	0.0	1.6	1.3
	1.35 - 1.50	35.0	4.5	15.1	0.7	0.01	1.1	1.8	0.0	3.8	2.2	0.2	0.0	---	0.5
	1.50 - 1.65	71.6	6.2	36.5	1.5	0.05	1.7	5.1	1.0	17.7	1.4	0.4	0.2	1.5	6.3
	Average*	33.1	5.5	24.8	1.5	0.03	1.5	2.5	0.1	6.7	2.4	3.8	0.1	2.6	2.5

X

TABLE II.10 **Calculated trace element data of selected coal seams - Sydnev Basin COAL**

		As	B	Ba	Be	Bi	Co	Cr	Cs	Cu	Ga	Ge	Hf	Hg	Li
SEAM		ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppb	ppm
Phalen Seam/	Roof	119	44	586	5.0	0.50	36	81	6.9	81.4	16.0	3.1	1.3	3.8	150
Phalen Collierv:															
Shale	0.00 - 0.15	32.4	7.1	768	3.5	0.01	0.9	0.5	0.1	2.3	6.7	53.2	0.0	0.5	1.4
Roof	0.15 - 0.30	9.7	7.4	21.3	1.1	0.03	1.1	4.9	---	5.7	1.9	1.1	---	1.4	5.2
	0.30 - 0.45	6.1	8.1	10.1	0.3	0.03	1.2	5.5	0.4	4.3	1.2	0.5	0.2	0.7	4.1
	0.45 - 0.60	1.1	7.0	24.7	0.4	0.04	2.0	7.0	0.8	5.4	1.9	0.3	0.4	1.4	8.7
	0.60 - 0.75	31.8	6.0	11.7	0.6	0.02	1.2	1.7	0.2	6.4	1.7	1.2	0.1	1.4	2.0
	0.75 - 0.83	12.5	9.5	35.8	0.5	0.04	1.2	12	1.2	8.1	3.4	0.4	0.2	1.9	19
	0.83 - 0.93	55.4	20	82.2	1.1	0.13	2.7	23	2.1	13.8	6.2	1.8	0.4	2.3	45
	0.93 - 1.08	134	13	38.3	1.6	0.06	0.0	8.6	0.7	11.9	3.1	0.7	0.1	5.5	22
	1.08 - 1.23	3.1	6.2	9.0	0.3	0.02	0.9	3.3	0.2	2.7	0.8	0.3	0.1	1.1	2.5
	1.23 - 1.38	1.1	8.5	19.3	0.4	0.05	1.4	7.2	0.7	5.7	1.9	0.3	0.3	1.2	5.5
	1.38 - 1.53	0.5	12	48.6	0.4	0.10	1.2	15	1.6	9.4	3.2	0.5	0.6	2.8	20
	1.53 - 1.68	4.9	5.7	3.6	0.1	0.02	0.6	2.1	0.1	3.4	0.7	0.1	0.1	1.0	2.4
	1.68 - 1.83	2.4	7.1	3.9	0.1	0.01	0.6	1.1	0.0	3.0	0.2	0.1	0.0	0.7	1.6
	1.83 - 1.98	137	5.0	13.9	1.1	0.01	0.8	0.1	0.0	4.4	2.5	0.3	0.1	1.0	1.2
	1.98 - 2.13	21.2	6.7	6.0	0.2	0.03	0.5	1.9	0.1	4.8	0.6	0.4	0.1	0.7	1.5
	2.13 - 2.28	63.3	6.3	9.6	0.6	0.02	0.8	2.4	0.1	5.5	0.3	0.4	0.0	3.4	1.2
	2.28 - 2.48	133	6.0	11.8	1.2	0.02	0.7	1.9	0.0	7.2	0.9	0.6	0.0	3.1	1.2
	Parting 0.05	209	33	148	4.6	0.33	19	37	2.5	45.7	5.4	2.1	0.8	5.4	32
	2.53 - 2.73	197	5.5	88.6	4.3	0.03	4.5	3.1	0.1	14.2	9.0	25.2	0.1	7.3	1.3
	Floor	62.0	81	542	4.5	0.27	27	90	7.2	40.4	19.1	4.5	3.6	2.2	54
	Average'	56.3	8.6	70.7	1.2	0.04	1.7	6.0	0.5	7.6	2.7	5.5	0.2	2.3	7.9

TABLE II.10 Calculated trace element data of selected coal seams - Sydney Basin COAL

SEAM		As ppm	B ppm	Ba ppm	Be ppm	Bi ppm	Co ppm	Cr ppm	Cs ppm	Cu ppm	Ga ppm	Ge ppm	Hf ppm	Hg ppb	Li ppm
Phalen Seam/		24.0	67	376	1.9	0.05	17	52	1.0	21.1	7.7	9.6	21	2.4	17
Phalen Colliery:	Roof	338	32	213	8.3	0.24	61	44	2.4	99.3	27.8	2.0	0.8	1.0	28
Sandstone															
Roof	0.00 - 0.15	66.0	15	55.9	8.4	0.06	2.3	11	1.3	7.5	11.1	20.5	0.6	2.5	14
	0.15 - 0.30	24.9	10	50.4	2.1	0.06	1.8	9.1	1.0	7.3	3.7	2.5	0.6	1.4	10
	0.30 - 0.45	17.9	6.4	232	0.7	0.02	0.7	1.8	0.1	2.9	1.6	0.8	0.1	0.7	2.9
	0.45 - 0.60	24.7	7.8	81.0	0.7	0.01	0.6	0.2	0.0	2.5	1.7	0.2	0.1	0.8	1.4
	0.60 - 0.75	7.8	7.2	58.4	0.3	0.02	0.8	0.6	0.0	2.8	1.0	0.3	0.1	0.3	1.3
	0.75 - 0.90	67.0	7.5	103	0.7	0.02	0.7	1.1	0.0	3.5	1.7	0.4	0.1	1.7	1.5
	0.90 - 1.05	5.9	7.8	118	0.2	0.03	0.6	2.2	0.0	4.0	0.7	0.3	0.1	0.2	1.6
	1.05 - 1.20	5.9	6.1	27.1	0.1	0.02	0.3	1.8	0.1	3.6	0.3	0.3	0.1	0.6	1.6
	1.20 - 1.35	95.9	6.1	31.4	0.8	0.04	0.7	1.2	0.0	7.1	2.1	1.0	0.1	1.6	1.2
	1.35 - 1.45	112	11	69.6	1.2	0.06	2.1	5.0	0.5	10.2	4.1	0.5	0.3	1.9	8.2
	Parting 0.05	235	47	152	4.2	0.42	18	47	2.8	45.5	13.1	4.7	2.3	9.4	75
	1.50 - 1.65	124	9.9	103	1.6	0.04	1.7	4.0	0.3	14.1	4.0	0.8	0.2	1.7	4.3
	1.65 - 1.80	311	25	153	3.4	0.25	9.9	25	1.1	33.9	11.3	1.4	0.8	2.8	34
	1.80 - 1.95	157	26	191	4.3	0.23	11	27	1.7	28.5	11.4	25.6	1.1	0.7	37
	Floor	55.4	102	615	4.6	0.28	39	111	8.3	32.3	25.8	4.6	3.7	2.3	78
	Average*	88.6	13	103	2.1	0.08	3.3	9.0	0.6	11.8	4.8	4.7	0.4	1.6	12

TABLE II.10 Calculated trace element data of selected coal seams - Sydnev Basin COAL

SEAM		Mo ppm	Ni ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Sn ppm	Sr ppm	Th ppm	Tl ppm	U ppm	V ppm	W ppm	Y ppm	Zn ppm	Zr ppm
Hub Seam/ Prince Mine: Shale Roof	Roof	1.7	70	76	142	1.9	20	5.2	692	17.5	0.9	4.6	156	3	20	64.9	161
	0.00 - 0.08	3.8	118	240	33	6.6	7.5	4.6	29	4.76	3.4	1.6	115	0.1	7.8	664	27
	0.08 - 0.23	1.2	5.4	11	2.0	0.64	0.9	15	8.2	0.51	0.15	0.13	9.5	0.3	2.2	50.7	7.6
	0.23 - 0.38	0.3	2.9	11	0.6	0.16	0.3	17	3.8	0.22	0.04	0.06	2.5	0.4	1.1	38.7	3.2
	0.38 - 0.53	0.3	2.3	3.4	1.8	0.01	0.2	13	9.8	0.34	0.05	0.12	4.7	0.7	1.4	44.7	4.5
	0.53 - 0.68	3.5	5.7	11	1.8	0.11	0.9	12	8.9	0.84	0.43	0.21	10	0.4	1.9	53.0	9.4
	0.68 - 0.83	0.4	1.7	3.0	0.7	0.02	0.1	6.1	10	0.17	0.03	0.06	2.0	0.3	1.3	38.3	2.2
	0.83 - 0.98	0.9	2.0	3.4	0.9	0.01	0.2	8.4	11	0.23	0.02	0.07	2.3	0.2	1.4	29.6	3.2
	0.98 - 1.13	0.4	2.7	6.5	1.8	0.04	0.2	8.1	4.7	0.32	0.09	0.10	4.0	0.1	0.5	29.9	4.8
	1.13 - 1.28	2.5	5.6	22	1.5	0.10	0.7	13	7.3	0.65	0.51	0.20	6.5	0.2	1.5	24.2	13
	1.28 - 1.43	1.7	1.5	24	0.1	0.22	0.1	18	10	0.12	0.74	0.05	2.1	0.1	0.7	37.4	0.1
	1.43 - 1.58	4.4	2.0	24	0.6	0.01	0.1	9.9	4.6	0.20	1.7	0.08	2.9	0.2	0.9	31.3	1.0
	1.58 - 1.73	3.4	3.2	9.3	1.0	0.08	0.3	17	8.0	0.21	0.33	0.09	2.6	0.2	0.5	18.8	2.8
	1.73 - 1.88	5.2	5.2	20	2.7	0.21	1.1	8.5	12	0.80	0.44	0.19	11	0.2	2.8	20.8	7.5
	1.88 - 2.03	12	11	45	10	1.4	1.2	4.9	107	1.82	2.5	0.52	26	0.7	3.6	18.9	16
	2.03 - 2.18	6.8	3.5	43	6.0	0.75	1.0	4.8	8.1	0.94	1.6	0.21	16	0.7	3.8	21.3	5.4
	2.18 - 2.33	5.6	5.9	49	21	0.36	1.8	4.3	10	2.13	1.7	0.47	21	0.9	7.0	68.3	18
	2.33 - 2.43	8.2	132	194	13	18.2	4.3	6.8	20	2.78	3.5	0.93	93	0.1	8.4	296	11
	Floor	0.9	50	42	180	1.7	17	4.3	174	13.6	1.0	3.6	165	2	10	56.5	138
	Average*	3.6	15	36	5.3	1.4	1.1	10	16	0.92	0.96	0.27	17	0.4	2.6	73.0	7.8
Hub Seam/ Prince Mine: Sandstone Roof	Roof	1.0	35	19	32	1.0	1.9	5.8	24	2.89	0.19	0.87	23	1	2.9	16.4	187
	0.00 - 0.15	2.4	28	138	1.7	2.4	2.0	4.2	7.6	0.45	2.4	0.21	23	0.6	5.1	12.0	1.4
	0.15 - 0.30	1.0	5.4	52	1.5	0.15	0.5	4.5	9.1	0.61	2.2	0.15	6.5	0.4	1.2	6.5	7.9
	0.30 - 0.45	0.9	4.2	38	0.5	0.07	0.4	---	7.7	0.45	1.3	0.13	4.7	0.6	1.9	10.4	1.8
	0.45 - 0.47	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	0.47 - 0.62	2.7	24	22	18	0.66	2.7	1.7	33	4.68	0.77	1.3	47	0.6	3.8	13.5	27
	0.62 - 0.77	0.6	3.0	7.5	1.4	0.04	0.4	11	5.6	0.38	0.43	0.11	4.5	0.4	1.1	7.5	1.5
	0.77 - 0.92	1.6	3.6	22	2.1	0.05	0.6	21	5.8	0.58	1.4	0.17	6.8	0.3	0.3	10.0	2.3
	0.92 - 1.07	1.5	3.1	3.1	3.3	0.01	0.6	11	12	0.33	0.08	0.09	5.5	0.1	1.8	6.9	6.0
	1.07 - 1.22	2.4	3.0	4.7	1.5	0.02	0.7	15	12	0.51	0.39	0.18	4.9	0.2	1.5	7.0	11
	1.22 - 1.37	8.2	3.3	11	0.8	0.14	0.2	---	6.9	0.24	1.0	0.08	2.9	0.3	1.2	10.4	1.3
	1.37 - 1.52	6.0	4.6	14	4.8	0.38	1.1	10	14	0.67	0.46	0.19	7.2	0.4	1.4	11.5	2.6
	Parting 0.01	14	24	33	62	0.41	9.0	2.8	153	16.9	0.62	3.7	68	3	11	18.0	264
	1.53 - 1.68	12	6.5	36	6.1	1.0	1.3	5.5	47	1.22	3.4	0.38	26	1	3.8	12.6	4.2
	1.68 - 1.83	10	11	34	12	0.49	1.1	3.2	83	1.64	2.3	0.38	26	0.9	3.6	18.4	12
	1.83 - 1.98	4.6	10	31	5.5	2.6	1.7	4.2	11	1.86	3.6	0.46	31	1	7.2	16.9	16
	Floor	0.9	30	15	147	0.56	13	9.3	134	11.4	0.65	3.2	131	2	8.4	39.2	266
	Average*	4.3	8.9	33	5.1	0.65	1.1	6.9	21	1.21	1.6	0.33	16	0.6	2.7	11.3	9.5

TABLE II.10 Calculated trace element data of selected coal seams - Svdney Basin COAL

SEAM		Mo ppm	Ni ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Sn ppm	Sr ppm	Th ppm	Tl ppm	U ppm	V ppm	W ppm	Y ppm	Zn ppm	Zr ppm
Harbour Seam/	Roof	3.5	70	46	183	0.88	21	11	273	16.2	1.2	4.1	167	2	17	61.7	144
Lingan Mine:																	
Shale	0.00 - 0.15	2.5	22	2.2	5.7	1.8	1.8	4.1	122	1.88	3.3	0.69	42	0.2	9.0	12.3	6.8
Roof	0.15 - 0.30	0.1	0.9	0.2	0.2	0.05	0.1	6.6	1.9	---	0.91	---	1.8	---	0.2	1.8	1.7
	0.30 - 0.45	0.2	0.8	0.5	1.5	0.03	0.1	24	2.1	0.23	0.68	0.06	1.8	0.3	0.4	1.4	1.6
	0.45 - 0.58	0.9	1.6	0.5	0.2	0.01	0.1	8.3	5.4	0.10	0.02	0.04	1.3	0.3	0.5	1.3	1.9
	0.58 - 0.63	0.9	1.7	1.2	0.6	0.01	0.4	11	4.7	0.36	0.04	0.11	2.6	0.1	0.9	1.2	5.9
	0.63 - 0.75	0.5	1.3	0.8	0.3	0.01	0.3	7.8	6.4	0.23	0.01	0.08	2.5	0.1	0.4	1.2	3.9
	0.75 - 0.90	0.9	1.4	0.2	0.2	0.01	0.0	5.8	5.3	0.09	0.05	0.03	1.3	0.2	0.3	1.2	1.3
	0.90 - 1.05	1.1	1.4	0.6	1.5	0.01	0.3	6.2	8.8	0.28	0.04	0.06	2.5	0.1	0.8	1.6	4.4
	1.05 - 1.20	2.1	4.7	5.2	7.5	0.07	1.9	1.5	40	2.29	0.13	0.48	18	0.3	2.5	3.9	30
	1.20 - 1.35	2.0	2.0	0.0	0.2	0.12	0.2	9.0	3.8	0.17	1.1	0.05	2.1	0.2	0.3	3.3	2.0
	1.35 - 1.50	3.2	0.6	0.1	0.2	0.03	0.1	4.7	5.8	0.07	0.02	0.02	1.1	0.5	1.1	2.4	0.7
	1.50 - 1.65	2.7	2.5	0.8	2.6	0.04	0.6	3.1	6.0	0.50	0.62	0.13	5.4	0.7	2.4	3.6	10
	1.65 - 1.80	3.0	3.9	1.1	2.3	3.1	1.3	5.9	10	0.74	0.57	0.20	12	0.9	5.3	8.4	5.7
	Floor	1.7	73	40	189	2.4	16	9.3	237	13.7	1.0	3.4	202	2	11	110	100
	Average"	1.6	3.7	1.0	1.9	0.44	0.6	7.3	19	0.56	0.64	0.15	7.9	0.3	2.0	3.6	6.0
Harbour Seam/	Roof	0.8	38	13	84	0.48	13	20	89	9.39	0.56	2.2	159	0.4	8.9	72.4	289
Lingan Mine:																	
Sandstone	0.00 - 0.15	1.3	5.8	1.8	5.5	0.08	1.1	4.7	8.9	0.63	3.3	0.18	8.8	0.3	4.8	7.7	9.9
Roof	0.15 - 0.30	0.9	1.3	0.6	3.6	0.04	0.2	4.0	4.8	0.26	0.93	0.06	3.5	0.4	1.0	1.5	1.7
	0.30 - 0.45	1.1	1.2	0.4	1.1	0.05	0.3	2.7	4.9	0.14	0.10	0.03	2.5	0.3	0.6	1.2	0.9
	0.45 - 0.55	1.0	2.1	0.5	0.2	0.03	0.2	11	6.4	0.32	0.06	0.11	4.6	0.3	1.1	1.3	4.0
	0.55 - 0.60	1.4	2.1	1.6	1.1	0.04	0.3	---	4.9	0.79	0.03	0.15	3.4	0.1	1.2	1.4	15
	0.60 - 0.75	0.0	1.0	0.7	1.5	0.03	0.3	8.7	5.2	0.29	0.07	0.08	2.7	0.2	0.2	1.8	3.1
	0.75 - 0.90	1.4	1.4	0.3	0.6	0.03	0.2	---	5.2	0.19	0.07	0.06	1.9	0.1	0.9	2.6	1.1
	0.90 - 1.05	1.7	0.1	0.3	0.6	0.01	0.2	2.0	5.4	0.19	0.08	---	3.9	0.1	0.0	0.4	0.7
	1.05 - 1.20	1.2	8.2	3.6	3.8	0.14	1.2	1.5	10	0.73	2.6	0.17	17	0.4	2.1	3.8	18
	1.20 - 1.35	3.0	0.9	0.0	0.1	0.05	0.0	11	3.7	0.13	0.40	0.02	3.1	0.1	1.3	4.4	2.3
	1.35 - 1.50	3.2	0.8	0.0	0.3	0.04	0.0	8.3	3.0	0.11	0.62	0.03	1.7	0.4	1.3	2.0	1.5
	1.50 - 1.65	6.8	3.4	1.5	6.1	0.17	0.9	1.5	7.9	0.96	1.2	0.23	11	1	3.8	18.5	19
	Average"	2.0	2.4	0.9	2.2	0.06	0.4	4.6	5.9	0.38	0.87	0.09	5.5	0.3	1.6	4.2	6.0

TABLE II.10 Calculated trace element data of selected coal seams - Sydney Basin COAL

SEAM		Mo ppm	Ni ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Sn ppm	Sr ppm	Th ppm	Tl ppm	U ppm	V ppm	W ppm	Y ppm	Zn ppm	Zr ppm
Phalen Seam/	Roof	3.8	175	100	84	5.8	13	---	205	11.2	2.5	2.8	131	1	15	182	88
Phalen Colliery:																	
Shale	0.00 - 0.15	1.1	0.8	1.8	0.3	5.3	0.7	14	29	0.16	0.50	0.08	2.4	0.8	3.8	4.2	0.2
Roof	0.15 - 0.30	3.5	3.1	1.6	4.6	0.16	0.9	8.4	34	---	0.53	---	6.9	---	2.6	5.2	9.8
	0.30 - 0.45	1.9	2.2	0.6	5.3	0.07	0.7	5.5	43	0.55	0.09	0.14	6.6	0.3	1.4	3.9	6.0
	0.45 - 0.60	2.9	3.1	1.1	11	0.04	1.6	5.5	43	1.03	0.10	0.24	11	0.2	3.4	5.2	15
	0.60 - 0.75	2.5	3.5	1.9	1.6	0.27	0.4	7.0	32	0.33	0.50	0.10	4.4	0.2	1.7	3.9	2.5
	0.75 - 0.83	1.8	5.7	4.4	13	0.13	2.1	---	55	1.53	0.29	0.51	16	0.1	3.2	8.1	13
	0.83 - 0.93	3.2	11	8.6	27	0.29	5.9	---	74	3.02	0.75	0.86	32	0.4	7.7	13.0	37
	0.93 - 1.08	14	8.3	6.5	8.6	0.24	2.1	---	25	1.37	1.6	0.33	16	0.3	4.0	7.4	12
	1.08 - 1.23	2.2	3.2	0.5	1.6	0.08	0.7	---	39	0.39	0.08	0.11	4.4	0.2	3.1	4.0	2.6
	1.23 - 1.38	1.5	2.9	1.3	7.8	0.08	1.8	---	55	1.18	0.06	0.30	12	0.1	3.3	5.3	11
	1.38 - 1.53	1.6	3.2	4.3	15	0.02	2.6	---	64	3.15	0.07	0.68	20	0.3	3.2	6.3	37
	1.53 - 1.68	2.7	1.8	0.5	0.9	0.03	0.3	4.3	56	0.21	0.05	0.05	2.6	0.2	0.8	5.2	1.8
	1.68 - 1.83	2.4	1.5	0.0	0.8	0.06	0.2	4.8	52	0.10	0.01	0.04	1.3	0.1	0.9	5.7	1.8
	1.83 - 1.98	6.8	1.1	0.7	2.2	0.10	0.0	12	17	0.19	1.1	0.07	2.7	0.1	0.3	9.3	0.3
	1.98 - 2.13	4.0	1.0	1.0	0.7	0.07	0.3	5.0	49	0.24	0.12	0.09	2.8	0.1	0.9	7.1	1.6
	2.13 - 2.28	8.1	2.3	0.1	1.0	0.11	0.4	---	43	0.34	0.13	0.13	3.8	0.2	1.2	8.4	1.9
	2.28 - 2.48	11	1.9	0.5	0.7	0.14	0.4	---	31	0.23	0.28	0.10	3.9	0.3	1.2	12.0	1.2
	Parting 0.05	33	75	10	32	0.50	5.0	---	165	6.07	4.2	1.7	50	0.4	16	83.1	65
	2.53 - 2.73	31	3.7	0.1	0.7	2.0	0.1	21	22	0.33	3.9	3.6	11	0.1	5.7	18.6	5.7
	Floor	12	72	68	146	2.9	17	---	225	12.0	1.1	15	117	2	14	243	227
	Average*	7.2	5.0	2.0	5.7	0.56	1.2	5.3	44	0.87	0.75	0.52	9.6	0.2	3.0	9.5	9.8

TABLE II.10 Calculated trace element data of selected coal seams - Sydney Basin COAL

SEAM		Mo ppm	Ni ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Sn ppm	Sr ppm	Th ppm	Tl ppm	U ppm	V ppm	W ppm	Y ppm	Zn ppm	Zr ppm
Phalen Seam/		2.9	25	12	47	0.77	4.8	79	107	9.60	0.19	3.4	59	0.5	9.6	21.1	869
Phalen Colliery:	Roof	19	115	191	19	4.0	4.0	15	40	4.37	3.9	1.8	195	0.4	6.8	21.9	32
Sandstone																	
Roof	0.00 - 0.15	0.1	5.4	9.4	21	0.26	3.2	28	28	1.76	2.5	0.53	26	0.6	4.3	8.7	25
	0.15 - 0.30	0.5	3.0	3.0	9.5	0.05	2.0	21	26	1.82	1.2	0.46	17	0.8	2.7	5.4	20
	0.30 - 0.45	0.7	1.3	0.5	1.6	0.03	0.4	22	21	0.33	0.83	0.09	4.4	0.6	0.2	2.7	2.2
	0.45 - 0.60	0.0	0.6	0.0	1.2	0.03	0.1	19	19	0.17	0.77	0.05	2.2	0.0	0.2	2.5	0.2
	0.60 - 0.75	1.4	8.9	0.4	0.4	0.04	0.1	16	41	0.12	0.27	0.04	1.6	0.1	0.5	4.2	0.1
	0.75 - 0.90	2.4	1.7	0.0	1.3	0.08	0.1	16	24	0.21	0.67	0.08	3.9	0.1	---	8.0	0.2
	0.90 - 1.05	3.7	1.8	0.0	0.4	0.16	0.3	17	43	0.26	0.14	0.10	3.5	0.1	0.7	6.5	2.3
	1.05 - 1.20	1.6	1.5	0.0	0.6	0.08	0.1	7.8	52	0.18	0.04	0.07	2.4	0.1	0.8	6.7	1.4
	1.20 - 1.35	15	1.6	1.0	1.5	0.10	0.1	19	28	0.27	0.62	0.12	2.8	0.2	0.0	7.1	1.2
	1.35 - 1.45	18	4.6	1.9	6.0	0.13	0.8	18	38	1.02	1.0	0.32	9.3	0.4	1.2	15.8	8.6
	Parting 0.05	36	43	5.6	29	0.28	5.2	37	172	7.51	3.4	1.7	61	0.2	15	46.9	80
	1.50 - 1.65	16	3.3	0.1	4.2	0.12	0.9	17	30	0.71	1.9	0.41	9.1	0.4	0.4	20.7	3.3
	1.65 - 1.80	29	22	5.7	12	1.2	3.1	42	74	3.39	6.8	1.0	34	0.6	7.1	28.3	38
	1.80 - 1.95	26	23	5.7	14	2.8	3.4	40	87	3.99	3.4	3.3	34	0.9	13	42.7	36
	Floor	19	76	26	186	3.1	19	72	222	11.1	1.6	6.4	157	0.9	18	231	151
	Average"	10	7.9	2.4	6.8	0.44	1.4	23	45	1.41	1.8	0.60	14	0.4	3.1	14.1	14

TABLE II.11 Rare earth element data of selected coal seams - Sydney Basin ASH

SEAM		La ppm	Ce ppm	Pr ppb	Nd ppm	Sm ppm	Eu ppm	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm
Hub Seam/ Prince Mine: Shale Roof	Roof	87.8	182	24.1	106	22.5	4.74	11.3	1.2	6.0	1.14	2.8	0.5	3.0	0.46
	0.00 - 0.08	44.4	87.7	9.9	36.7	6.6	1.44	4.9	0.9	5.6	1.11	3.0	0.5	2.8	0.48
	0.08 - 0.23	81.3	176	20.4	89.6	17.6	4.64	19.9	2.5	12.8	2.40	6.6	1.0	6.3	0.71
	0.23 - 0.38	58.7	113	13.6	58.5	12.0	2.47	11.8	1.4	6.9	1.24	2.9	0.4	2.3	0.32
	0.38 - 0.53	115	224	27.5	118	21.5	4.90	20.5	2.5	12.8	2.21	5.7	0.6	4.7	0.75
	0.53 - 0.68	74.5	152	18.1	77.2	12.4	2.92	12.3	1.6	8.9	1.70	4.7	0.7	4.4	0.59
	0.68 - 0.83	111	207	26.3	108	18.9	3.99	16.6	2.0	10.8	1.94	5.2	0.4	4.8	0.51
	0.83 - 0.98	92.0	165	22.0	90.6	16.2	4.04	16.5	2.1	10.8	2.17	5.5	0.8	4.4	0.64
	0.98 - 1.13	99.0	184	20.9	82.1	15.3	3.92	14.8	2.1	10.5	2.10	5.2	0.7	4.6	0.64
	1.13 - 1.28	62.7	115	13.6	54.8	10.0	2.49	9.6	1.1	6.4	1.18	3.5	0.5	3.1	0.46
	1.28 - 1.43	44.3	78.4	9.1	37.1	6.8	1.70	6.6	0.9	4.6	0.86	2.3	0.3	1.8	0.23
	1.43 - 1.58	28.9	51.2	6.1	26.6	4.8	1.05	5.2	0.5	3.3	0.55	1.5	0.1	1.2	0.13
	1.58 - 1.73	87.5	159	18.1	82.7	16.2	3.53	14.8	1.8	9.3	1.68	4.5	0.5	3.3	0.49
	1.73 - 1.88	91.3	173	19.9	82.9	14.7	3.75	15.4	2.0	11.6	2.44	6.3	1.0	5.1	0.81
	1.88 - 2.03	114	210	24.4	97.7	16.4	3.21	9.6	1.3	6.1	1.25	2.4	0.5	2.6	0.38
	2.03 - 2.18	35.1	78.2	10.0	42.1	8.3	2.02	8.2	1.2	6.7	1.35	3.3	0.5	2.9	0.46
	2.18 - 2.33	46.7	109	13.0	55.1	10.6	2.79	10.2	1.6	9.1	1.76	4.5	0.6	3.8	0.58
	2.33 - 2.43	24.6	51.5	6.0	24.4	4.7	1.43	6.0	1.1	7.8	1.54	4.4	0.7	4.1	0.69
	Floor	60.1	111	12.4	43.1	4.8	0.93	2.4	0.5	2.8	0.60	1.5	0.3	1.9	0.30
	Average*	72.1	139	16.6	69.4	12.7	3.00	12.1	1.6	8.5	1.62	4.2	0.6	3.7	0.52
Hub Seam/ Prince Mine: Sandstone Roof	Roof	8.3	19.0	2.3	9.5	1.4	0.32	1.0	<0.1	0.7	0.16	0.2	<0.1	0.4	0.10
	0.00 - 0.15	15.2	32.5	4.4	19.6	4.5	1.46	4.8	0.9	5.6	1.34	3.4	0.7	3.2	0.56
	0.15 - 0.30	36.6	67.3	8.2	33.1	5.4	1.24	4.8	0.7	3.6	0.67	1.6	0.3	1.6	0.27
	0.30 - 0.45	45.9	88.4	10.7	44.7	8.0	1.87	7.8	1.0	5.8	1.01	2.6	0.3	2.0	0.22
	0.45 - 0.47	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	0.47 - 0.62	74.3	133	16.1	60.5	9.8	2.41	7.7	1.1	6.5	1.28	3.1	0.3	3.2	0.47
	0.62 - 0.77	90.2	194	23.3	100	18.9	4.74	19.5	2.5	13.5	2.52	6.5	0.9	5.5	0.70
	0.77 - 0.92	49.8	100	11.9	48.4	10.1	2.27	9.8	1.3	6.7	1.35	3.3	0.5	3.2	0.42
	0.92 - 1.07	113	219	25.4	101	16.4	4.34	16.7	2.3	12.8	2.65	7.1	0.9	5.6	0.71
	1.07 - 1.22	86.0	167	19.1	74.3	12.9	2.96	13.0	1.7	10.2	2.06	5.0	0.8	5.6	0.69
	1.22 - 1.37	35.7	65.0	8.0	33.4	6.3	1.45	7.3	0.9	5.1	0.88	2.2	0.2	2.0	0.22
	1.37 - 1.52	66.8	130	15.6	64.8	11.3	3.01	12.6	1.7	9.3	1.81	4.8	0.6	4.8	0.53
	Parting 0.01	70.2	149	16.0	55.9	7.5	1.43	5.0	0.6	4.0	0.87	2.2	0.3	2.9	0.47
	1.53 - 1.68	53.1	108	12.9	50.8	9.6	2.69	10.6	1.4	8.1	1.60	3.9	0.4	3.5	0.51
	1.68 - 1.83	67.4	143	16.7	68.0	11.1	3.06	10.3	1.2	6.6	1.26	3.2	0.3	2.9	0.45
	1.83 - 1.98	41.3	108	13.0	57.9	11.8	3.39	12.9	1.9	11.7	2.39	6.2	0.7	5.6	0.82
	Floor	34.7	69.9	8.1	28.7	4.0	0.83	2.6	0.3	2.3	0.52	1.3	<0.1	1.8	0.30
	Average*	59.1	119	14.1	57.6	10.4	2.66	10.5	1.4	8.0	1.59	4.0	0.5	3.7	0.51

TABLE II.11 Rare earth element data of selected coal seams - Sydney Basin ASH

SEAM		La ppm	Ce ppm	Pr ppb	Nd ppm	Sm ppm	Eu ppm	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm
Harbour Seam/ Lingan Mine: Shale Roof	Roof	58.6	105	12.9	49.9	8.5	1.87	5.5	0.8	4.3	0.92	2.0	0.4	2.5	0.44
	0.00 - 0.15	78.5	181	23.4	108	21.9	5.86	22.8	3.4	18.0	3.33	8.3	1.1	6.2	0.86
	0.15 - 0.30	24.1	47.8	5.8	23.6	4.4	1.01	4.2	0.6	3.0	0.58	1.6	0.2	1.2	0.16
	0.30 - 0.45	32.8	59.1	7.2	29.1	4.9	1.31	5.1	0.6	3.1	0.61	1.6	0.2	1.3	0.21
	0.45 - 0.58	96.2	161	22.5	88.8	15.1	4.25	16.3	2.3	12.9	2.69	6.4	0.8	4.5	0.60
	0.58 - 0.63	98.2	173	20.4	87.5	15.2	3.40	13.5	1.7	8.8	1.58	3.8	0.5	3.7	0.51
	0.63 - 0.75	90.1	156	21.5	83.0	14.2	3.50	14.6	2.0	10.3	2.05	4.9	0.7	4.1	0.58
	0.75 - 0.90	55.4	86.2	10.6	45.9	7.0	1.46	6.3	0.7	3.9	0.81	1.5	0.2	2.1	0.20
	0.90 - 1.05	86.1	151	17.8	73.4	12.6	2.61	10.5	1.4	7.6	1.26	3.8	0.4	3.4	0.48
	1.05 - 1.20	93.1	163	19.5	76.8	12.8	2.60	9.0	1.3	6.8	1.14	3.0	0.5	3.0	0.52
	1.20 - 1.35	34.5	72.1	9.7	41.6	6.9	1.65	7.1	1.0	5.1	0.96	2.5	0.4	1.9	0.20
	1.35 - 1.50	115	232	30.1	131	23.4	6.12	25.3	3.3	16.7	3.48	8.6	1.1	6.4	0.86
	1.50 - 1.65	79.7	194	22.2	103	20.6	4.58	19.6	2.1	10.9	2.16	5.8	0.7	4.9	0.67
	1.65 - 1.80	89.8	238	27.8	125	23.6	6.54	24.1	3.3	16.7	3.21	8.1	1.2	7.9	1.03
	Floor	50.3	99.4	12.1	47.8	8.0	1.65	4.8	0.7	3.4	0.70	1.4	0.3	1.9	0.33
	Average*	73.0	146	18.1	77.5	14.0	3.45	13.7	1.8	9.5	1.84	4.6	0.6	3.9	0.53
Harbour Seam/ Lingan Mine: Sandstone Roof	Roof	59.9	124	13.0	50.9	8.6	2.11	6.1	0.7	3.3	0.54	1.3	<0.1	1.5	0.28
	0.00 - 0.15	39.7	81.1	9.5	41.5	8.5	2.90	10.5	1.5	8.9	1.88	5.3	0.6	4.0	0.61
	0.15 - 0.30	32.8	58.2	7.0	28.9	5.2	1.37	4.8	0.5	3.9	0.82	1.9	<0.2	1.5	0.27
	0.30 - 0.45	19.6	32.1	4.1	17.1	2.8	0.68	2.7	0.3	1.9	0.40	1.0	<0.1	0.9	0.14
	0.45 - 0.55	45.6	84.4	9.9	40.3	7.4	2.05	7.2	0.9	5.3	1.10	2.7	0.4	2.5	0.34
	0.55 - 0.60	41.4	72.2	8.6	33.8	5.5	1.00	4.5	0.5	3.0	0.51	1.4	0.1	1.3	0.16
	0.60 - 0.75	38.9	70.8	8.4	35.5	5.7	1.37	6.0	0.7	3.9	0.77	1.8	0.2	1.7	0.19
	0.75 - 0.90	28.1	48.8	6.1	25.5	4.1	0.87	4.2	0.5	2.9	0.49	1.3	<0.1	1.1	0.10
	0.90 - 1.05	40.8	73.0	9.3	40.3	6.5	1.88	5.2	<0.4	4.9	0.59	1.7	<0.4	1.5	0.23
	1.05 - 1.20	54.5	101	12.8	51.9	9.2	2.09	7.6	1.2	5.8	1.05	2.6	0.4	2.3	0.37
	1.20 - 1.35	43.3	78.3	9.6	39.9	6.6	1.62	6.5	0.7	4.5	0.89	2.1	0.2	2.1	0.27
	1.35 - 1.50	45.5	96.7	11.2	50.3	8.9	2.58	10.6	1.2	6.7	1.32	3.7	0.5	2.9	0.43
	1.50 - 1.65	63.5	154	17.2	75.4	15.3	4.01	15.4	1.8	10.2	1.93	5.1	0.6	4.5	0.69
	Average*	41.1	79.8	9.5	40.5	7.3	1.92	7.3	0.9	5.3	1.01	2.6	0.3	2.2	0.33

TABLE II.11 Rare earth element data of selected coal seams - Sydney Basin ASH

SEAM		La ppm	Ce ppm	Pr ppb	Nd ppm	Sm ppm	Eu ppm	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm
Phalen Seam/	Roof	78.6	164	20.9	85.3	15.4	2.76	8.4	1.0	5.7	1.06	3.1	0.3	3.0	0.35
Phalen Colliery:															
Shale	0.00 - 0.15	13.0	48.3	7.4	40.7	13.3	4.08	19.3	3.0	17.8	3.65	10.2	1.4	9.1	1.24
Roof	0.15 - 0.30	52.2	107	12.0	49.9	8.4	1.98	9.0	1.1	5.9	1.11	2.8	0.4	2.8	0.33
	0.30 - 0.45	59.0	119	13.8	56.1	8.6	2.00	7.2	1.0	5.0	1.11	2.9	0.3	2.7	0.35
	0.45 - 0.60	49.0	106	12.6	51.6	9.4	1.90	7.5	1.1	6.4	1.20	3.6	0.5	3.0	0.41
	0.60 - 0.75	68.8	147	16.2	67.7	15.0	4.01	14.9	2.0	9.6	1.81	4.4	0.6	3.5	0.49
	0.75 - 0.83	92.1	173	21.5	81.7	15.9	3.72	14.9	2.1	11.0	1.89	4.8	0.6	4.1	0.60
	0.83 - 0.93	69.5	127	15.4	63.2	12.2	2.97	11.2	1.6	8.9	1.50	4.2	0.5	3.8	0.47
	0.93 - 1.08	36.8	75.4	9.3	39.2	7.4	1.82	7.0	0.9	5.0	0.89	2.3	0.2	2.1	0.25
	1.08 - 1.23	45.5	91.9	11.5	53.1	12.1	3.26	14.7	1.8	9.4	1.70	4.3	0.4	3.3	0.40
	1.23 - 1.38	71.2	142	16.9	70.5	13.7	3.07	13.1	1.7	9.8	1.81	4.7	0.6	4.4	0.55
	1.38 - 1.53	90.1	169	20.1	73.9	11.4	2.00	8.1	1.2	6.6	1.27	4.0	0.5	4.1	0.64
	1.53 - 1.68	55.9	108	12.1	52.2	10.0	2.11	9.0	1.2	6.4	1.17	3.3	0.5	2.8	0.41
	1.68 - 1.83	43.5	79.7	9.3	40.2	7.8	1.69	6.9	0.9	5.6	1.00	2.9	0.3	2.3	0.26
	1.83 - 1.98	15.1	27.7	3.2	12.5	2.4	0.46	2.3	0.3	1.6	0.30	0.7	0.1	0.8	0.13
	1.98 - 2.13	35.7	64.9	7.7	31.1	5.5	1.38	5.5	0.8	4.4	0.88	2.3	0.3	2.1	0.26
	2.13 - 2.28	17.5	32.6	4.1	17.1	3.2	0.71	3.5	0.4	2.7	0.45	1.3	0.1	1.1	0.12
	2.28 - 2.48	19.0	39.3	4.8	21.6	4.1	1.06	4.3	0.5	3.1	0.66	1.8	0.1	1.5	0.20
	Parting 0.05	61.6	118	13.4	53.8	8.8	2.11	8.7	1.1	6.4	1.19	3.0	0.3	2.6	0.33
	2.53 - 2.73	15.2	43.5	5.4	27.0	6.6	2.23	9.2	1.5	9.6	2.00	5.6	0.8	4.7	0.67
	Floor	60.6	123	14.3	54.3	7.1	1.37	4.6	0.5	3.6	0.67	2.1	0.2	2.4	0.33
	Average*	45.2	91.2	10.9	45.7	9.0	2.19	9.1	1.3	7.1	1.35	3.7	0.5	3.2	0.43

TABLE II.11 Rare earth element data of selected coal seams - Sydney Basin ASH

SEAM		La ppm	Ce ppm	Pr ppb	Nd ppm	Sm ppm	Eu ppm	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm
Phalen Seam/		40.6	94.2	10.0	41.6	6.4	1.10	4.3	0.4	2.2	0.46	1.1	0.2	0.9	0.15
Phalen Colliery:	Roof	47.5	88.4	9.4	36.5	5.7	1.34	5.6	0.6	3.6	0.71	1.8	0.3	1.7	0.22
Sandstone															
Roof	0.00 - 0.15	41.0	87.8	9.9	38.9	7.6	2.22	9.1	1.2	6.8	1.36	3.6	0.5	3.4	0.45
	0.15 - 0.30	65.0	132	14.5	55.2	9.4	2.26	7.6	1.0	5.9	1.14	3.0	0.4	3.4	0.49
	0.30 - 0.45	39.8	80.3	9.3	36.1	6.3	1.33	6.5	0.7	3.9	0.89	2.0	0.3	2.0	0.25
	0.45 - 0.60	20.6	39.1	4.5	17.7	3.2	0.68	2.9	0.3	2.4	0.48	1.1	0.2	1.0	0.17
	0.60 - 0.75	27.4	51.8	6.2	25.6	4.5	1.03	4.3	0.6	3.5	0.70	1.8	0.2	1.6	0.19
	0.75 - 0.90	19.1	35.9	4.1	16.6	2.9	0.67	2.8	0.3	2.3	0.44	1.1	0.2	1.2	0.15
	0.90 - 1.05	45.2	89.7	10.4	43.0	7.3	1.63	6.5	1.0	5.4	1.00	2.8	0.3	2.4	0.31
	1.05 - 1.20	38.1	71.7	8.5	31.3	4.8	1.03	5.5	0.6	3.6	0.56	1.6	0.2	1.6	0.22
	1.20 - 1.35	18.0	35.8	4.1	16.4	2.6	0.58	3.3	0.3	2.0	0.47	1.2	0.2	1.1	0.13
	1.35 - 1.45	44.8	88.6	9.7	38.8	7.1	1.72	7.2	0.8	4.6	0.89	2.3	0.3	2.1	0.27
	Parting 0.05	63.0	124	13.5	57.4	9.1	1.94	7.6	1.0	6.1	1.12	2.7	0.3	2.4	0.27
	1.50 - 1.65	39.6	82.1	9.2	37.8	6.8	1.81	7.5	0.9	5.6	1.12	3.0	0.5	2.8	0.36
	1.65 - 1.80	53.7	106	12.3	46.8	7.8	1.72	7.5	1.0	5.0	0.97	2.9	0.4	2.0	0.27
	1.80 - 1.95	61.5	123	13.5	55.1	10.1	2.35	10.6	1.3	8.6	1.73	4.9	0.5	3.4	0.49
	Floor	51.8	110	12.4	48.3	7.7	1.62	5.9	0.6	4.1	0.87	2.2	0.4	2.6	0.36
	Average*	40.8	81.4	9.2	36.6	6.4	1.50	6.4	0.8	4.7	0.93	2.5	0.3	2.2	0.29

TABLE II.12 Calculated rare earth element data of selected coal seams - Sydney Basin COAL

SEAM		La ppm	Ce ppm	Pr ppb	Nd ppm	Sm ppm	Eu ppm	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm
Hub Seam/ Prince Mine: Shale Roof	Roof	76.0	158	20.9	91.8	19.5	4.10	9.78	1.04	5.20	0.99	2.4	0.43	2.6	0.40
	0.00 - 0.08	12.8	25.3	2.86	10.6	1.91	0.42	1.41	0.26	1.62	0.32	0.87	0.14	0.81	0.14
	0.08 - 0.23	2.75	5.95	0.69	3.03	0.59	0.16	0.67	0.08	0.43	0.08	0.22	0.03	0.21	0.02
	0.23 - 0.38	1.75	3.36	0.40	1.74	0.36	0.07	0.35	0.04	0.21	0.04	0.09	0.01	0.07	0.01
	0.38 - 0.53	2.45	4.77	0.59	2.51	0.46	0.10	0.44	0.05	0.27	0.05	0.12	0.01	0.10	0.02
	0.53 - 0.68	3.29	6.71	0.80	3.41	0.55	0.13	0.54	0.07	0.39	0.08	0.21	0.03	0.19	0.03
	0.68 - 0.83	1.58	2.94	0.37	1.53	0.27	0.06	0.24	0.03	0.15	0.03	0.07	0.01	0.07	0.01
	0.83 - 0.98	1.51	2.71	0.36	1.49	0.27	0.07	0.27	0.03	0.18	0.04	0.09	0.01	0.07	0.01
	0.98 - 1.13	2.47	4.58	0.52	2.04	0.38	0.10	0.37	0.05	0.26	0.05	0.13	0.02	0.11	0.02
	1.13 - 1.28	2.92	5.35	0.63	2.55	0.47	0.12	0.45	0.05	0.30	0.05	0.16	0.02	0.14	0.02
	1.28 - 1.43	1.27	2.25	0.26	1.07	0.20	0.05	0.19	0.03	0.13	0.02	0.07	0.01	0.05	0.01
	1.43 - 1.58	1.31	2.32	0.28	1.21	0.22	0.05	0.24	0.02	0.15	0.02	0.07	0.00	0.05	0.01
	1.58 - 1.73	1.89	3.43	0.39	1.78	0.35	0.08	0.32	0.04	0.20	0.04	0.10	0.01	0.07	0.01
	1.73 - 1.88	4.32	8.19	0.94	3.92	0.70	0.18	0.73	0.09	0.55	0.12	0.30	0.05	0.24	0.04
	1.88 - 2.03	13.5	24.9	2.89	11.6	1.94	0.38	1.14	0.15	0.72	0.15	0.28	0.06	0.31	0.04
	2.03 - 2.18	3.93	8.75	1.12	4.71	0.93	0.23	0.92	0.13	0.75	0.15	0.37	0.06	0.32	0.05
	2.18 - 2.33	7.09	16.6	1.97	8.37	1.61	0.42	1.55	0.24	1.38	0.27	0.68	0.09	0.58	0.09
	2.33 - 2.43	5.60	11.7	1.37	5.55	1.07	0.33	1.37	0.25	1.78	0.35	1.0	0.16	0.93	0.16
	Floor	52.2	96.4	10.8	37.4	4.17	0.81	2.08	0.43	2.43	0.52	1.3	0.26	1.7	0.26
	Average"	5.03	9.70	1.16	4.85	0.89	0.21	0.84	0.11	0.59	0.11	0.29	0.04	0.26	0.04
Hub Seam/ Prince Mine: Sandstone Roof	Roof	7.99	18.3	2.21	9.14	1.35	0.31	0.96	0.00	0.67	0.15	0.19	0.00	0.38	0.10
	0.00 - 0.15	2.14	4.58	0.62	2.76	0.63	0.21	0.68	0.13	0.79	0.19	0.48	0.10	0.45	0.08
	0.15 - 0.30	2.66	4.88	0.60	2.40	0.39	0.09	0.35	0.05	0.26	0.05	0.12	0.02	0.12	0.02
	0.30 - 0.45	2.51	4.84	0.59	2.45	0.44	0.10	0.43	0.05	0.32	0.06	0.14	0.02	0.11	0.01
	0.45 - 0.47	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	0.47 - 0.62	11.7	20.9	2.53	9.50	1.54	0.38	1.21	0.17	1.02	0.20	0.49	0.05	0.50	0.07
	0.62 - 0.77	2.11	4.55	0.55	2.34	0.44	0.11	0.46	0.06	0.32	0.06	0.15	0.02	0.13	0.02
	0.77 - 0.92	2.61	5.24	0.62	2.53	0.53	0.12	0.51	0.07	0.35	0.07	0.17	0.03	0.17	0.02
	0.92 - 1.07	2.50	4.84	0.56	2.23	0.36	0.10	0.37	0.05	0.28	0.06	0.16	0.02	0.12	0.02
	1.07 - 1.22	2.01	3.91	0.45	1.74	0.30	0.07	0.30	0.04	0.24	0.05	0.12	0.02	0.13	0.02
	1.22 - 1.37	1.28	2.33	0.29	1.20	0.23	0.05	0.26	0.03	0.18	0.03	0.08	0.01	0.07	0.01
	1.37 - 1.52	3.19	6.21	0.75	3.10	0.54	0.14	0.60	0.08	0.44	0.09	0.23	0.03	0.23	0.03
	Parting 0.01	48.5	103	11.1	38.6	5.18	0.99	3.46	0.41	2.76	0.60	1.5	0.21	2.0	0.32
	1.53 - 1.68	5.58	11.3	1.36	5.34	1.01	0.28	1.11	0.15	0.85	0.17	0.41	0.04	0.37	0.05
	1.68 - 1.83	8.26	17.5	2.05	8.33	1.36	0.38	1.26	0.15	0.81	0.15	0.39	0.04	0.36	0.06
	1.83 - 1.98	5.38	14.1	1.69	7.54	1.54	0.44	1.68	0.25	1.52	0.31	0.81	0.09	0.73	0.11
	Floor	32.4	65.2	7.55	26.8	3.73	0.77	2.42	0.28	2.14	0.48	1.2	0.00	1.7	0.28
	Average"	4.90	9.85	1.17	4.78	0.86	0.22	0.87	0.12	0.67	0.13	0.33	0.04	0.31	0.04

TABLE II.12 Calculated rare earth element data of selected coal seams - Sydney Basin COAL

SEAM		La ppm	Ce ppm	Pr ppb	Nd ppm	Sm ppm	Eu ppm	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm
Harbour Seam/	Roof	51.6	92.5	11.4	44.0	7.49	1.65	4.84	0.70	3.79	0.81	1.8	0.35	2.2	0.39
Lingan Mine:															
Shale	0.00 - 0.15	8.76	20.2	2.61	12.1	2.45	0.65	2.55	0.38	2.01	0.37	0.93	0.12	0.69	0.10
Roof	0.15 - 0.30	0.92	1.83	0.22	0.90	0.17	0.04	0.16	0.02	0.11	0.02	0.06	0.01	0.05	0.01
	0.30 - 0.45	1.10	1.99	0.24	0.98	0.16	0.04	0.17	0.02	0.10	0.02	0.05	0.01	0.04	0.01
	0.45 - 0.58	0.91	1.52	0.21	0.84	0.14	0.04	0.15	0.02	0.12	0.03	0.06	0.01	0.04	0.01
	0.58 - 0.63	1.96	3.45	0.41	1.74	0.30	0.07	0.27	0.03	0.18	0.03	0.08	0.01	0.07	0.01
	0.63 - 0.75	1.39	2.40	0.33	1.28	0.22	0.05	0.22	0.03	0.16	0.03	0.08	0.01	0.06	0.01
	0.75 - 0.90	1.12	1.74	0.21	0.92	0.14	0.03	0.13	0.01	0.08	0.02	0.03	0.00	0.04	0.00
	0.90 - 1.05	1.83	3.21	0.38	1.56	0.27	0.06	0.22	0.03	0.16	0.03	0.08	0.01	0.07	0.01
	1.05 - 1.20	8.72	15.3	1.83	7.20	1.20	0.24	0.84	0.12	0.64	0.11	0.28	0.05	0.28	0.05
	1.20 - 1.35	1.20	2.50	0.34	1.44	0.24	0.06	0.25	0.03	0.18	0.03	0.09	0.01	0.07	0.01
	1.35 - 1.50	1.19	2.41	0.31	1.36	0.24	0.06	0.26	0.03	0.17	0.04	0.09	0.01	0.07	0.01
	1.50 - 1.65	3.05	7.43	0.85	3.95	0.79	0.18	0.75	0.08	0.42	0.08	0.22	0.03	0.19	0.03
	1.65 - 1.80	4.43	11.7	1.37	6.17	1.16	0.32	1.19	0.16	0.82	0.16	0.40	0.06	0.39	0.05
	Floor	42.4	83.8	10.2	40.3	6.75	1.39	4.05	0.59	2.87	0.59	1.2	0.25	1.6	0.28
	Average*	2.96	5.90	0.73	3.14	0.57	0.14	0.56	0.07	0.39	0.07	0.19	0.03	0.16	0.02
Harbour Seam/	Roof	47.7	98.7	10.3	40.5	6.85	1.68	4.86	0.56	2.63	0.43	1.0	0.00	1.2	0.22
Lingan Mine:															
Sandstone	0.00 - 0.15	3.49	7.13	0.84	3.65	0.75	0.26	0.92	0.13	0.78	0.17	0.47	0.05	0.35	0.05
Roof	0.15 - 0.30	1.64	2.91	0.35	1.44	0.26	0.07	0.24	0.02	0.19	0.04	0.09	0.00	0.07	0.01
	0.30 - 0.45	1.06	1.73	0.22	0.92	0.15	0.04	0.15	0.02	0.10	0.02	0.05	0.00	0.05	0.01
	0.45 - 0.55	1.90	3.51	0.41	1.68	0.31	0.09	0.30	0.04	0.22	0.05	0.11	0.02	0.10	0.01
	0.55 - 0.60	2.83	4.94	0.59	2.31	0.38	0.07	0.31	0.03	0.21	0.03	0.10	0.01	0.09	0.01
	0.60 - 0.75	1.66	3.03	0.36	1.52	0.24	0.06	0.26	0.03	0.17	0.03	0.08	0.01	0.07	0.01
	0.75 - 0.90	1.22	2.11	0.26	1.10	0.18	0.04	0.18	0.02	0.13	0.02	0.06	0.00	0.05	0.00
	0.90 - 1.05	1.44	2.59	0.33	1.43	0.23	0.07	0.18	0.01	0.17	0.02	0.06	0.01	0.05	0.01
	1.05 - 1.20	4.84	8.97	1.14	4.61	0.82	0.19	0.67	0.11	0.52	0.09	0.23	0.04	0.20	0.03
	1.20 - 1.35	2.01	3.64	0.45	1.85	0.31	0.08	0.30	0.03	0.21	0.04	0.10	0.01	0.10	0.01
	1.35 - 1.50	1.45	3.08	0.36	1.60	0.28	0.08	0.34	0.04	0.21	0.04	0.12	0.02	0.09	0.01
	1.50 - 1.65	4.89	11.8	1.32	5.80	1.18	0.31	1.18	0.14	0.78	0.15	0.39	0.05	0.35	0.05
	Average*	2.29	4.44	0.53	2.25	0.40	0.11	0.41	0.05	0.29	0.06	0.15	0.02	0.12	0.02

TABLE II.12 Calculated rare earth element data of selected coal seams - Sydney Basin COAL

SEAM		La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
		ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Phalen Seam/	Roof	49.2	103	13.1	53.4	9.64	1.73	5.26	0.63	3.57	0.66	1.9	0.19	1.9	0.22
Phalen Collier															
Shale	0.00 - 0.15	0.58	2.14	0.33	1.81	0.59	0.18	0.86	0.13	0.79	0.16	0.45	0.06	0.40	0.06
Roof	0.15 - 0.30	2.97	6.09	0.68	2.84	0.48	0.11	0.51	0.06	0.34	0.06	0.16	0.02	0.16	0.02
	0.30 - 0.45	2.98	6.00	0.70	2.83	0.43	0.10	0.36	0.05	0.25	0.06	0.15	0.02	0.14	0.02
	0.45 - 0.60	2.65	5.73	0.68	2.79	0.51	0.10	0.41	0.06	0.35	0.06	0.19	0.03	0.16	0.02
	0.60 - 0.75	2.77	5.92	0.65	2.73	0.60	0.16	0.60	0.08	0.39	0.07	0.18	0.02	0.14	0.02
	0.75 - 0.83	6.76	12.7	1.58	6.00	1.17	0.27	1.09	0.15	0.81	0.14	0.35	0.04	0.30	0.04
	0.83 - 0.93	12.4	22.7	2.75	11.3	2.18	0.53	2.00	0.29	1.59	0.27	0.75	0.09	0.68	0.08
	0.93 - 1.08	5.47	11.2	1.38	5.82	1.10	0.27	1.04	0.13	0.74	0.13	0.34	0.03	0.31	0.04
	1.08 - 1.23	2.35	4.75	0.59	2.75	0.63	0.17	0.76	0.09	0.49	0.09	0.22	0.02	0.17	0.02
	1.23 - 1.38	4.65	9.28	1.10	4.61	0.89	0.20	0.86	0.11	0.64	0.12	0.31	0.04	0.29	0.04
	1.38 - 1.53	9.60	18.0	2.14	7.87	1.21	0.21	0.86	0.13	0.70	0.14	0.43	0.05	0.44	0.07
	1.53 - 1.68	1.46	2.81	0.32	1.36	0.26	0.05	0.23	0.03	0.17	0.03	0.09	0.01	0.07	0.01
	1.68 - 1.83	0.86	1.57	0.18	0.79	0.15	0.03	0.14	0.02	0.11	0.02	0.06	0.01	0.05	0.01
	1.83 - 1.98	0.94	1.72	0.20	0.78	0.15	0.03	0.14	0.02	0.10	0.02	0.04	0.01	0.05	0.01
	1.98 - 2.13	1.33	2.42	0.29	1.16	0.20	0.05	0.20	0.03	0.16	0.03	0.09	0.01	0.08	0.01
	2.13 - 2.28	1.23	2.29	0.29	1.20	0.23	0.05	0.25	0.03	0.19	0.03	0.09	0.01	0.08	0.01
	2.28 - 2.48	1.14	2.37	0.29	1.30	0.25	0.06	0.26	0.03	0.19	0.04	0.11	0.01	0.09	0.01
	Parting 0.05	25.6	49.1	5.57	22.4	3.66	0.88	3.62	0.46	2.66	0.49	1.2	0.12	1.1	0.14
	2.53 - 2.73	1.67	4.77	0.59	2.96	0.72	0.24	1.01	0.16	1.05	0.22	0.61	0.09	0.51	0.07
	Floor	54.5	111	12.9	48.8	6.38	1.23	4.13	0.45	3.24	0.60	1.9	0.18	2.2	0.30
	Average*	3.54	7.15	0.85	3.58	0.70	0.17	0.71	0.10	0.55	0.11	0.29	0.04	0.25	0.03

TABLE II.12 Calculated rare earth element data of selected coal seams - Sydney Basin COAL

SEAM		La ppm	Ce ppm	Pr ppb	Nd ppm	Sm ppm	Eu ppm	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm
Phalen Seam/ Phalen Collier	Roof	18.9	35.1	3.74	14.5	2.26	0.53	2.23	0.24	1.43	0.28	0.72	0.12	0.68	0.09
Sandstone Roof	0.00 - 0.15	6.02	12.9	1.45	5.71	1.12	0.33	1.34	0.18	1.00	0.20	0.53	0.07	0.50	0.07
	0.15 - 0.30	5.39	10.9	1.20	4.58	0.78	0.19	0.63	0.08	0.49	0.09	0.25	0.03	0.28	0.04
	0.30 - 0.45	1.58	3.19	0.37	1.43	0.25	0.05	0.26	0.03	0.15	0.04	0.08	0.01	0.08	0.01
	0.45 - 0.60	0.85	1.61	0.18	0.73	0.13	0.03	0.12	0.01	0.10	0.02	0.05	0.01	0.04	0.01
	0.60 - 0.75	0.76	1.44	0.17	0.71	0.13	0.03	0.12	0.02	0.10	0.02	0.05	0.01	0.04	0.01
	0.75 - 0.90	0.80	1.50	0.17	0.70	0.12	0.03	0.12	0.01	0.10	0.02	0.05	0.01	0.05	0.01
	0.90 - 1.05	1.22	2.42	0.28	1.16	0.20	0.04	0.18	0.03	0.15	0.03	0.08	0.01	0.06	0.01
	1.05 - 1.20	0.97	1.83	0.22	0.80	0.12	0.03	0.14	0.02	0.09	0.01	0.04	0.01	0.04	0.01
	1.20 - 1.35	0.91	1.81	0.21	0.83	0.13	0.03	0.17	0.02	0.10	0.02	0.06	0.01	0.06	0.01
	1.35 - 1.45	4.17	8.24	0.90	3.61	0.66	0.16	0.67	0.07	0.43	0.08	0.21	0.03	0.20	0.03
	Parting 0.05	29.6	58.2	6.33	26.9	4.27	0.91	3.57	0.47	2.86	0.53	1.3	0.14	1.1	0.13
	1.50 - 1.65	3.28	6.79	0.76	3.13	0.56	0.15	0.62	0.07	0.46	0.09	0.25	0.04	0.23	0.03
	1.65 - 1.80	15.2	30.0	3.48	13.2	2.21	0.49	2.12	0.28	1.41	0.27	0.82	0.11	0.57	0.08
	1.80 - 1.95	17.5	35.0	3.84	15.7	2.88	0.67	3.02	0.37	2.45	0.49	1.4	0.14	0.97	0.14
	Floor	47.8	102	11.4	44.6	7.11	1.50	5.45	0.55	3.78	0.80	2.0	0.37	2.4	0.33
	Average*	4.65	9.28	1.05	4.17	0.73	0.17	0.73	0.09	0.54	0.11	0.28	0.04	0.25	0.03

Table II.13 Chondrite normalized values for seam averages* of rare earth elements from the Sydney Basin.

SEAM/SITE	ROOF ROCK	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
Chondrites:		0.329	0.865	0.112	0.63	0.203	0.077	0.276	0.047	0.343	0.07	0.225	0.03	0.22	0.0339
ASH															
Hub Seam/	shale	219	161	148	110	62.6	38.9	43.8	33.6	24.8	23.2	18.7	19.2	16.6	15.3
Prince Mine	sandstone	179	137	126	91.5	51.0	34.5	37.9	30.1	23.4	22.7	17.9	17.5	16.9	14.9
Harbour Seam/	shale	222	168	162	123	68.9	44.8	49.7	38.8	27.8	26.3	20.6	20.7	17.7	15.6
Lingan Mine	sandstone	125	92.2	85.3	64.4	35.8	25.0	26.4	18.2	15.5	14.4	11.7	9.7	10.2	9.6
Phalen Seam/	shale	137	105	97.0	72.5	44.2	28.5	33.0	26.8	20.6	19.3	16.3	15.2	14.6	12.7
Phalen Colliery	sandstone	124	94.1	82.3	58.0	31.4	19.5	23.2	16.8	13.8	13.3	11.0	11.0	10.0	8.6
COAL															
Hub Seam/	shale	15.3	11.2	10.4	7.7	4.4	2.72	3.1	2.34	1.7	1.62	1.3	1.34	1.2	1.07
Prince Mine	sandstone	14.9	11.4	10.5	7.6	4.2	2.87	3.1	2.50	1.9	1.88	1.5	1.46	1.4	1.24
Harbour Seam/	shale	9.0	6.8	6.6	5.0	2.8	1.82	2.0	1.57	1.1	1.06	0.8	0.84	0.7	0.63
Lingan Mine	sandstone	6.9	5.1	4.7	3.6	2.0	1.39	1.5	1.01	0.9	0.80	0.6	0.54	0.6	0.54
Phalen Seam/	shale	10.8	8.3	7.6	5.7	3.5	2.23	2.6	2.10	1.6	1.51	1.3	1.19	1.1	1.00
Phalen Colliery	sandstone	14.1	10.7	9.4	6.6	3.6	2.22	2.6	1.92	1.6	1.51	1.3	1.25	1.1	0.98

TABLE II.14Volatile elements as determined by neutron activation and wet chemistry* methods on whole coal basis.

SEAM/SITE	INTERVAL	Cl ppm	As ppm	F ppm	Hg* ppb
Hub Seam/ Prince Mine: Shale Roof	Roof	3080	420	<120	280
	0.00 - 0.08	2610	110	<50	890
	0.08 - 0.23	3840	2.7	<50	81
	0.23 - 0.38	3240	0.60	na	16
	0.38 - 0.53	3150	0.30	na	11
	0.53 - 0.68	4260	23.0	<50	32
	0.68 - 0.83	4390	0.4	<50	<5
	0.83 - 0.98	4020	1.3	<50	<5
	0.98 - 1.13	4140	2.1	230	19
	1.13 - 1.28	3100	24.0	na	74
	1.28 - 1.43	4250	31.0	<50	180
	1.43 - 1.58	3310	64.0	na	240
	1.58 - 1.73	3280	27.0	na	170
	1.73 - 1.88	3490	44.0	330	51
	1.88 - 2.03	3170	120.0	na	270
	2.03 - 2.18	2300	94.0	na	380
	2.18 - 2.33	3550	110	<110	160
	2.33 - 2.43	290	32.0	<50	130
	Floor	570	55.0	na	69
	Average"	3358	40	---	147
Hub Seam/ Prince Mine: Sandstone Roof	Roof	1060	22.0	<200	62
	0.00 - 0.15	2640	190	160	290
	0.15 - 0.30	2740	63.0	na	440
	0.30 - 0.45	3790	39.0	270	290
	0.45 - 0.47	10100	6.3	440	69
	0.47 - 0.62	3540	28.0	<460	120
	0.62 - 0.77	3820	47.0	na	120
	0.77 - 0.92	3600	110	na	150
	0.92 - 1.07	3280	17.0	na	46
	1.07 - 1.22	2900	10.0	na	67
	1.22 - 1.37	3510	61.0	na	150
	1.37 - 1.52	3890	31.0	na	38
	Parting 0.01	730	150	na	110
	1.53 - 1.68	3940	200	<250	340
	1.68 - 1.83	4570	120	450	240
	1.83 - 1.98	4040	270	<300	200
	Floor	490	5.7	<250	23
	Average"	3572	92	---	190

TABLE II.14 Volatile elements as determined by neutron activation and wet chemistry* methods on whole coal basis.

SEAM/SITE	INTERVAL	Cl ppm	As ppm	F ppm	Hg* ppb
Harbour Seam/ Lingan Mine: Shale Roof	Roof	670	29.0	<250	210
	0.00 - 0.15	670	59.0	na	890
	0.15 - 0.30	580	58.0	na	540
	0.30 - 0.45	650	49.0	na	430
	0.45 - 0.58	730	0.50	na	23
	0.58 - 0.63	750	0.60	na	11
	0.63 - 0.75	1100	0.30	na	23
	0.75 - 0.90	1350	0.30	na	12
	0.90 - 1.05	1380	0.40	na	13
	1.05 - 1.20	1530	7.1	<350	75
	1.20 - 1.35	1290	98.0	na	170
	1.35 - 1.50	1260	4.60	na	24
	1.50 - 1.65	950	86.0	na	180
	1.65 - 1.80	980	24.0	na	45
	Floor	1240	37.0	280	150
	Average"	1033	33	---	206
Harbour Seam/ Lingan Mine: Sandstone Roof	Roof	360	18.0	<370	90
	0.00 - 0.15	330	19.0	290	230
	0.15 - 0.30	270	22.0	na	360
	0.30 - 0.45	420	50.0	<150	310
	0.45 - 0.55	530	21.0	<150	250
	0.55 - 0.60	400	110	<110	520
	0.60 - 0.75	490	23.0	na	260
	0.75 - 0.90	910	32.0	<80	210
	0.90 - 1.05	690	21.0	na	170
	1.05 - 1.20	980	42.0	<190	200
	1.20 - 1.35	780	33.0	190	130
	1.35 - 1.50	800	30.0	na	120
	1.50 - 1.65	730	84.0	<220	90
	Average"	627	37	---	220

TABLE II.14 **Volatile elements as determined by neutron activation and wet chemistry* methods on whole coal basis.**

SEAM/SITE	INTERVAL	Cl ppm	As ppm	F ppm	Hg* ppb
Phalen Seam/	Roof	1060	100	<210	220
Phalen Colliery:					
Shale	0.00 - 0.15	2640	22.0	na	140
Roof	0.15 - 0.30	2940	8.40	na	75
	0.30 - 0.45	3110	5.70	na	17
	0.45 - 0.60	2730	0.80	na	12
	0.60 - 0.75	2850	26.0	na	93
	0.75 - 0.83	2710	10.0	na	29
	0.83 - 0.93	2690	42.0	na	130
	0.93 - 1.08	3450	92.0	<50	120
	1.08 - 1.23	3810	1.20	na	15
	1.23 - 1.38	2930	0.50	na	6
	1.38 - 1.53	3700	0.2	<180	9
	1.53 - 1.68	5110	3.4	180	16
	1.68 - 1.83	5200	0.3	<50	<5
	1.83 - 1.98	4770	93.0	<50	290
	1.98 - 2.13	5590	15.0	<50	18
	2.13 - 2.28	4700	52.0	180	37
	2.28 - 2.48	3260	100	na	90
	2.48 - 2.53	1960	140	na	220
	2.53 - 2.73	3560	180	<50	330
	Floor	980	44.0	<410	79
	Average"	3640	44	---	90

TABLE II.14 Volatile elements as determined by neutron activation and wet chemistry* methods on whole coal basis.

SEAM/SITE	INTERVAL	Cl ppm	As ppm	F ppm	Hg* ppb
Phalen Seam/		3680	25	na	18
Phalen Colliery:	Roof	1860	330	na	160
Sandstone Roof	0.00 - 0.15	3730	89	na	34
	0.15 - 0.30	2650	58	na	69
	0.30 - 0.45	4010	13	na	59
	0.45 - 0.60	4120	24	na	86
	0.60 - 0.75	4550	7	na	31
	0.75 - 0.90	4640	43	na	38
	0.90 - 1.05	4460	5	na	20
	1.05 - 1.20	5030	2	na	13
	1.20 - 1.35	4340	69	na	28
	1.35 - 1.45	3150	14	na	52
	1.45 - 1.50	1830	190	na	93
	1.50 - 1.65	3810	96	na	170
	1.65 - 1.80	2160	310	na	200
	1.80 - 1.95	2560	130	na	160
	Floor	1310	45	na	24
	Average"	3679	77	---	79

APPENDIX II C. MAJOR AND TRACE ELEMENT ANALYSIS

List of Figures

Variation in: $SiO_2 + Al_2O_3$
Fe_2O_3
$MgO + MnO$
CaO
in whole coal

FIGURE II.10 Hub Seam - Shale Roof

FIGURE II.11 Hub Seam - Sandstone Roof

FIGURE II.12 Harbour Seam - Shale Roof

FIGURE II.13 Harbour Seam - Sandstone Roof

FIGURE II.14 Phalen Seam - Shale Roof

FIGURE II.15 Phalen Seam - Sandstone Roof

FIGURE II.10

HUB SEAM – PRINCE MINE
Whole Coal – Cal.
Shale Roof

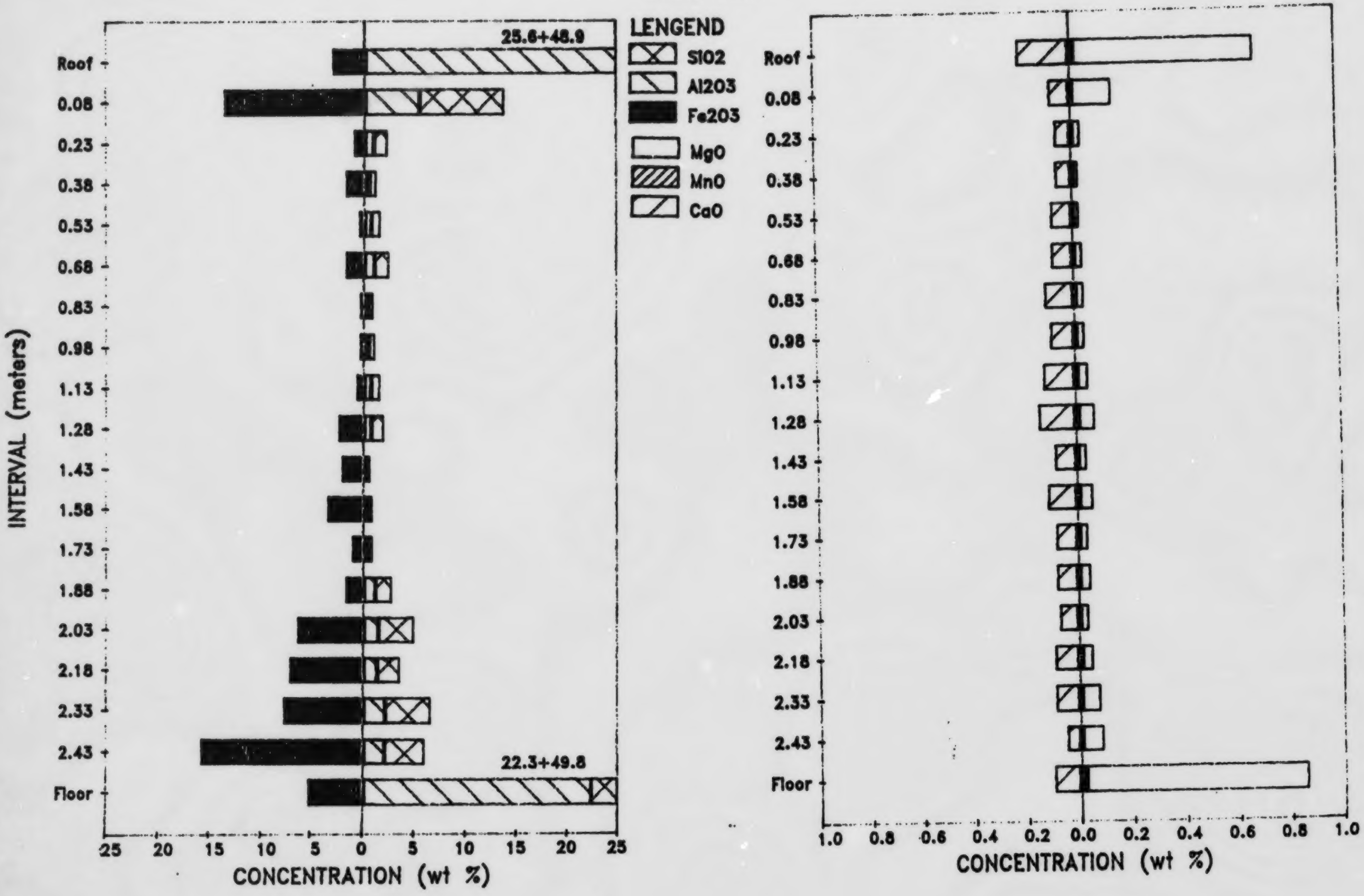


FIGURE II.11

HUB SEAM – PRINCE MINE
Whole Coal – Cal.
Sandstone Roof

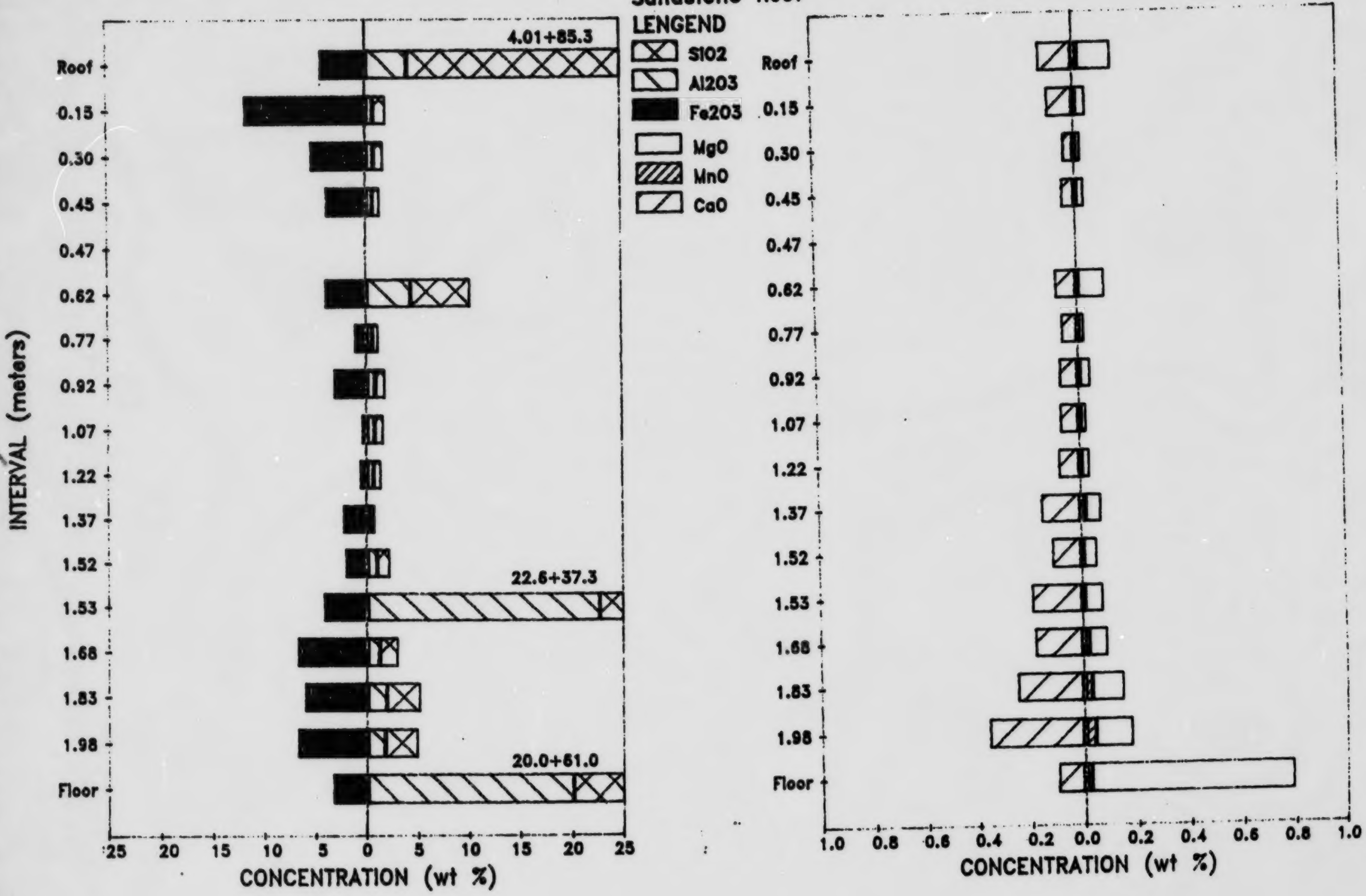


FIGURE II.12

HARBOUR SEAM – LINGAN MINE
Whole Coal – Cal.
Shale Roof

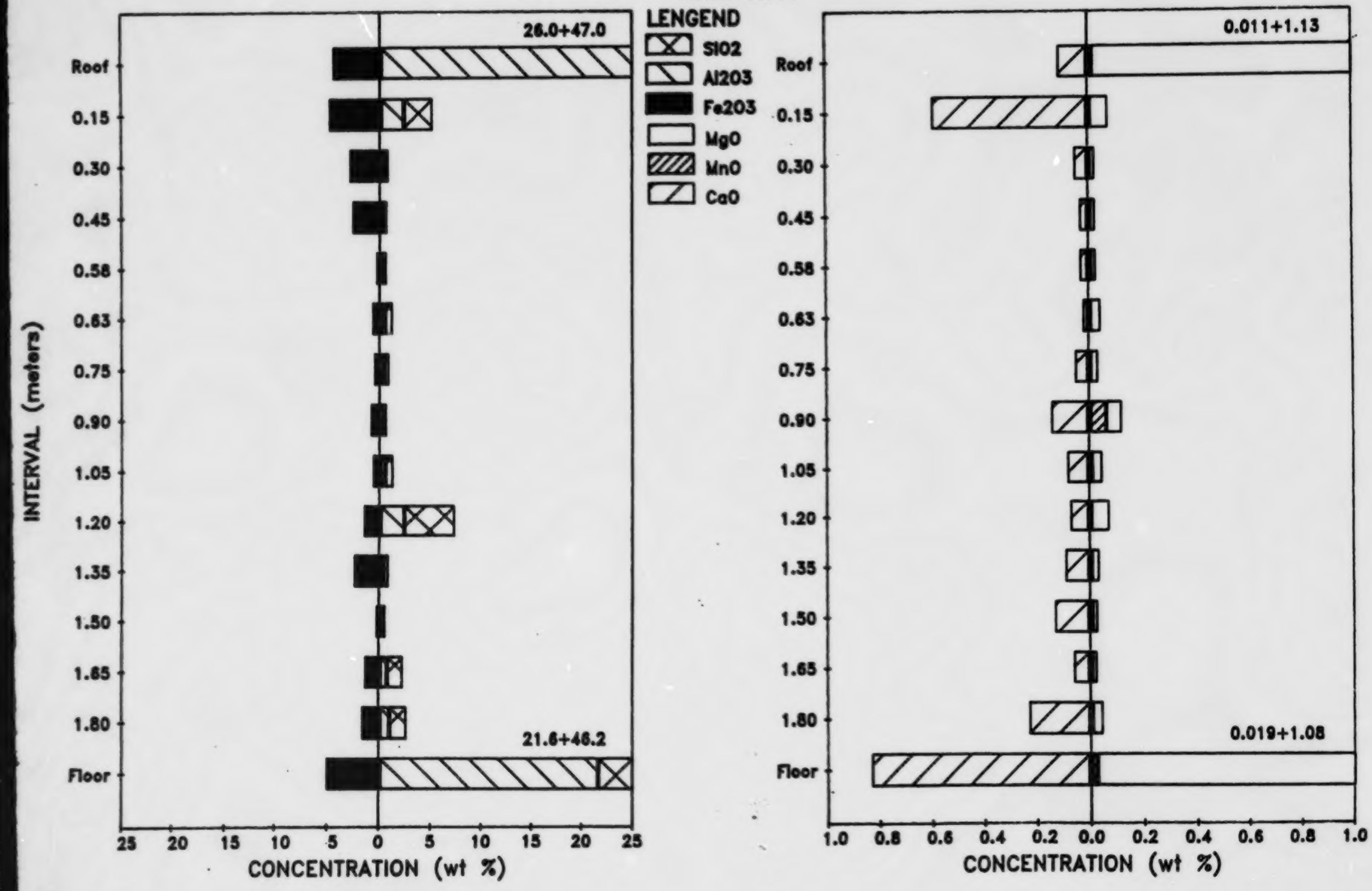


FIGURE II.13

HARBOUR SEAM – LINGAN MINE
Whole Coal – Cal.
Sandstone Roof

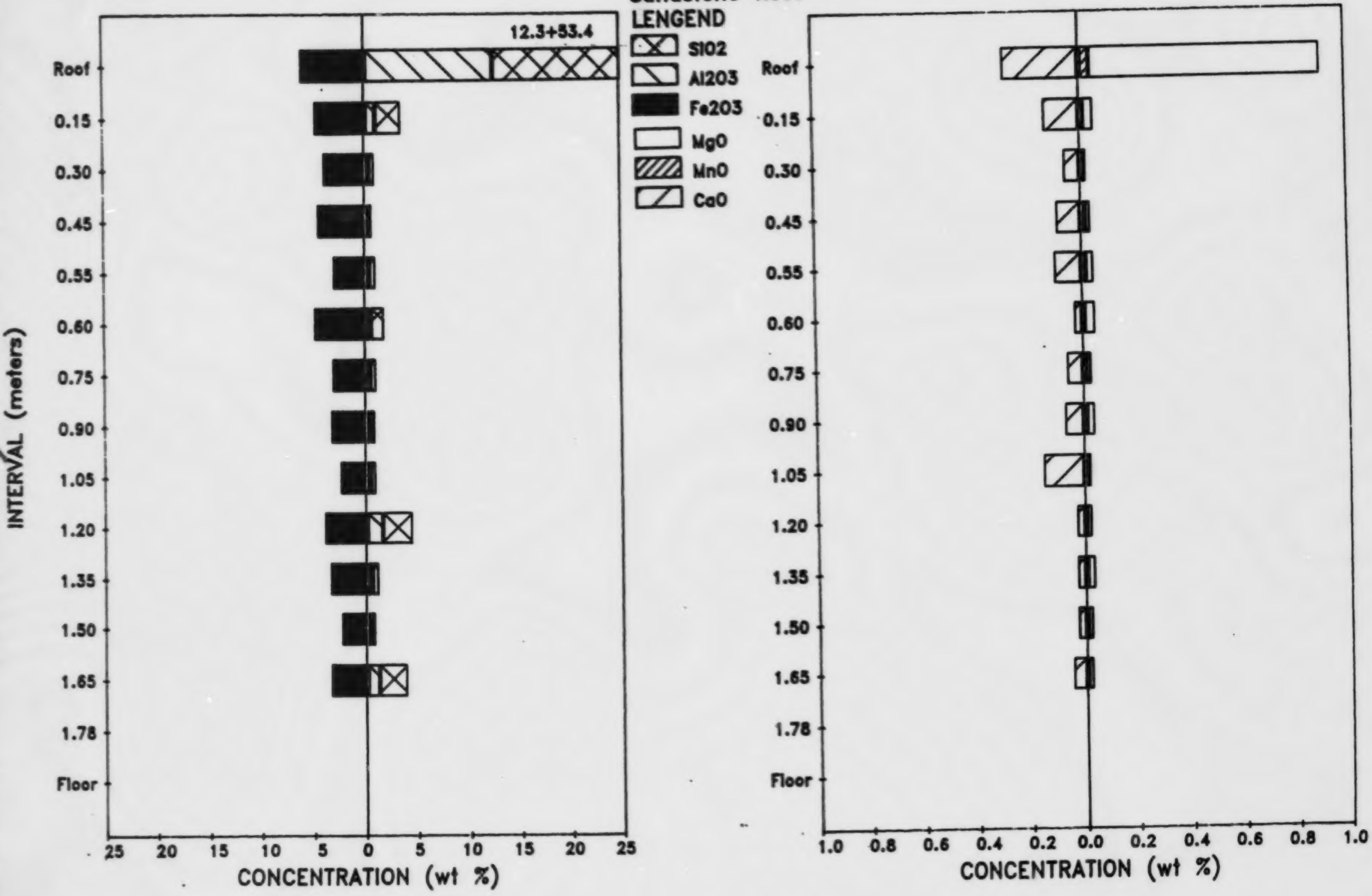


FIGURE II.14

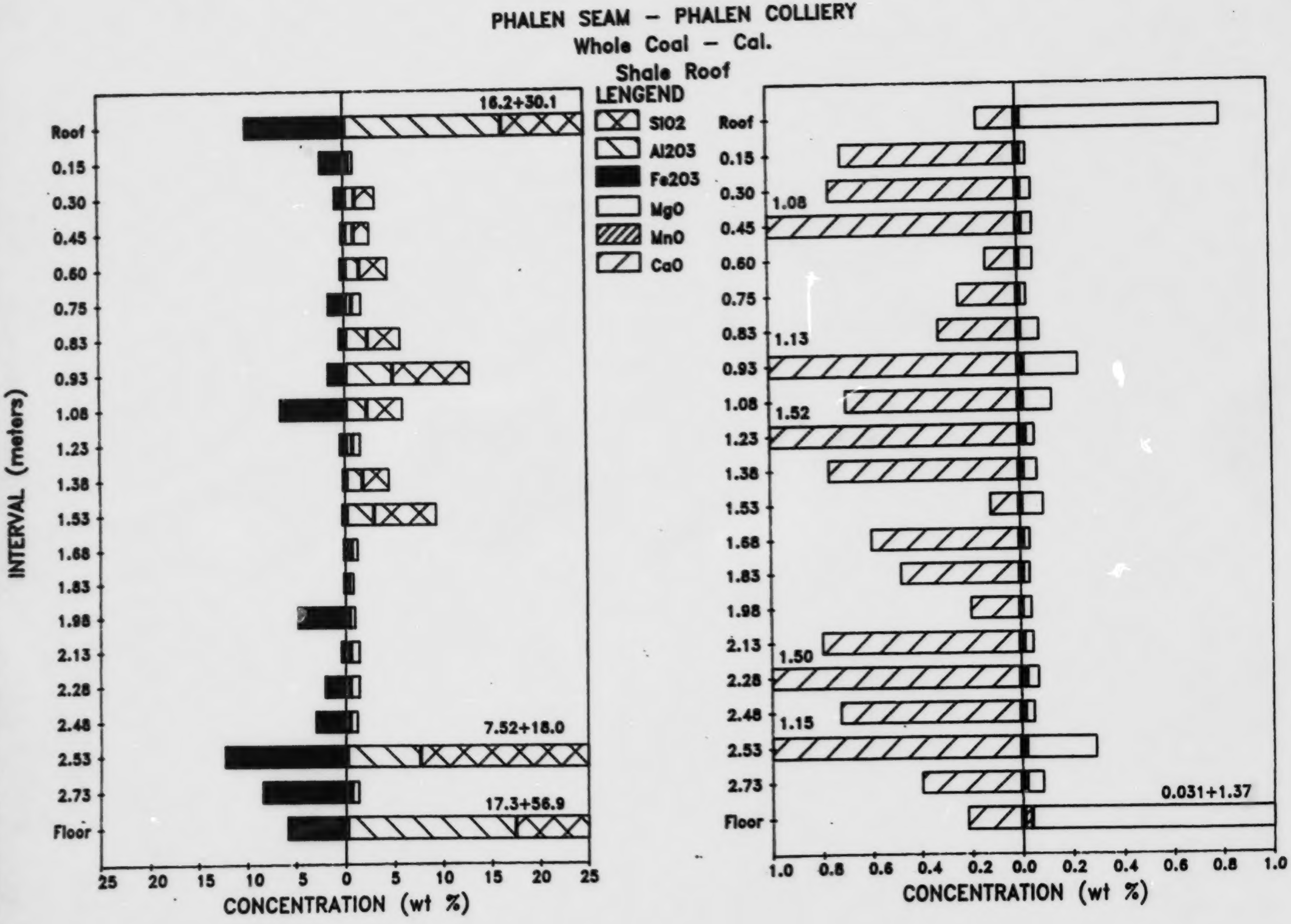
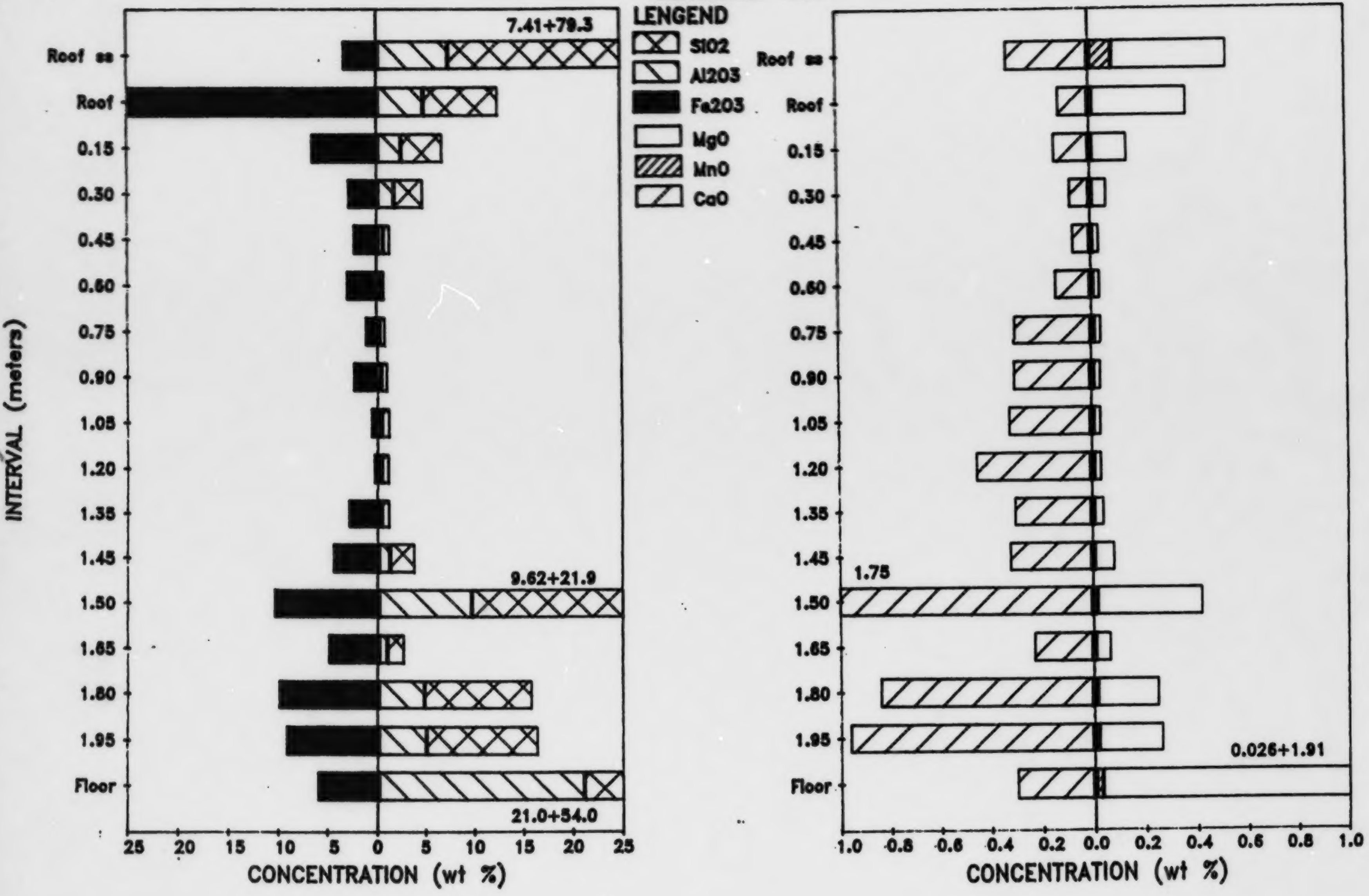

PHALEN SEAM – PHALEN COLLIERY
Whole Coal – Cal.
Shale Roof
LENGEND
SiO2
Al2O3
Fe2O3
MgO
MnO
CaO
INTERVAL (meters)
Roof
0.15
0.30
0.45
0.60
0.75
0.83
0.93
1.08
1.23
1.38
1.53
1.68
1.83
1.98
2.13
2.28
2.48
2.53
2.73
Floor
16.2+30.1
7.52+18.0
17.3+56.9
25
20
15
10
5
0
5
10
15
20
25
CONCENTRATION (wt %)
1.08
1.13
1.52
1.50
1.15
0.031+1.37
1.0
0.8
0.6
0.4
0.2
0.0
0.2
0.4
0.6
0.8
1.0
CONCENTRATION (wt %)

FIGURE II.15

PHALEN SEAM – PHALEN COLLIERY
Whole Coal – Cal.
Sandstone Roof



APPENDIX II.C MAJOR AND TRACE ELEMENT ANALYSIS

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(Continued)

Variation in: Pb
Zn
Cu
Mo
in whole coal

FIGURE II.16 Hub Seam - Shale Roof

FIGURE II.17 Hub Seam - Sandstone Roof

FIGURE II.18 Harbour Seam - Shale Roof

FIGURE II.19 Harbour Seam - Sandstone Roof

FIGURE II.20 Phalen Seam - Shale Roof

FIGURE II.21 Phalen Seam - Sandstone Roof

FIGURE II.16

HUB SEAM – PRINCE MINE
Whole Coal – Cal.
Shale Roof

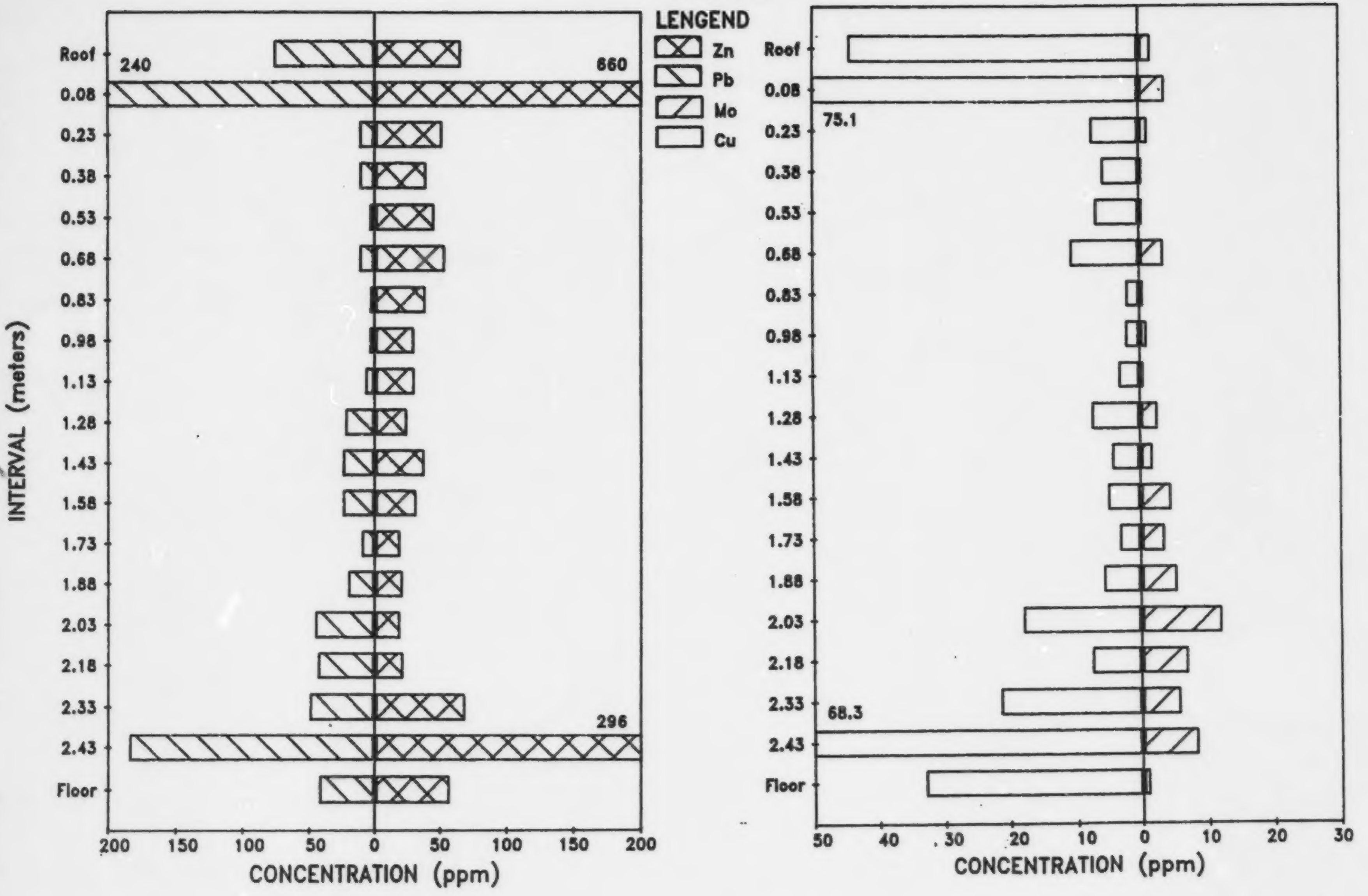


FIGURE II.17

HUB SEAM – PRINCE MINE
Whole Coal – Cal.
Sandstone Roof

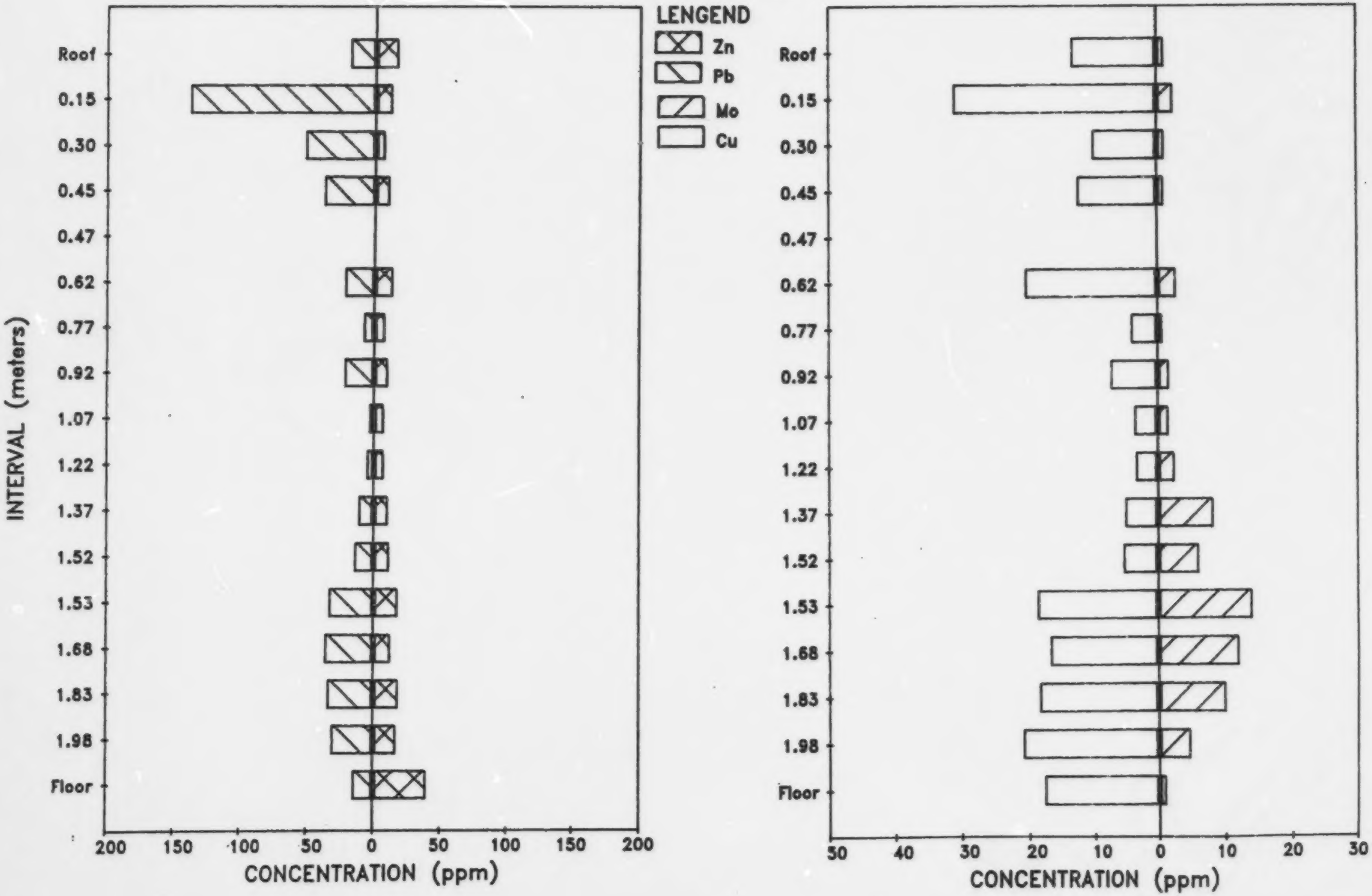


FIGURE II.18

HARBOUR SEAM — LINGAN MINE
Whole Coal — Cal.
Shale Roof

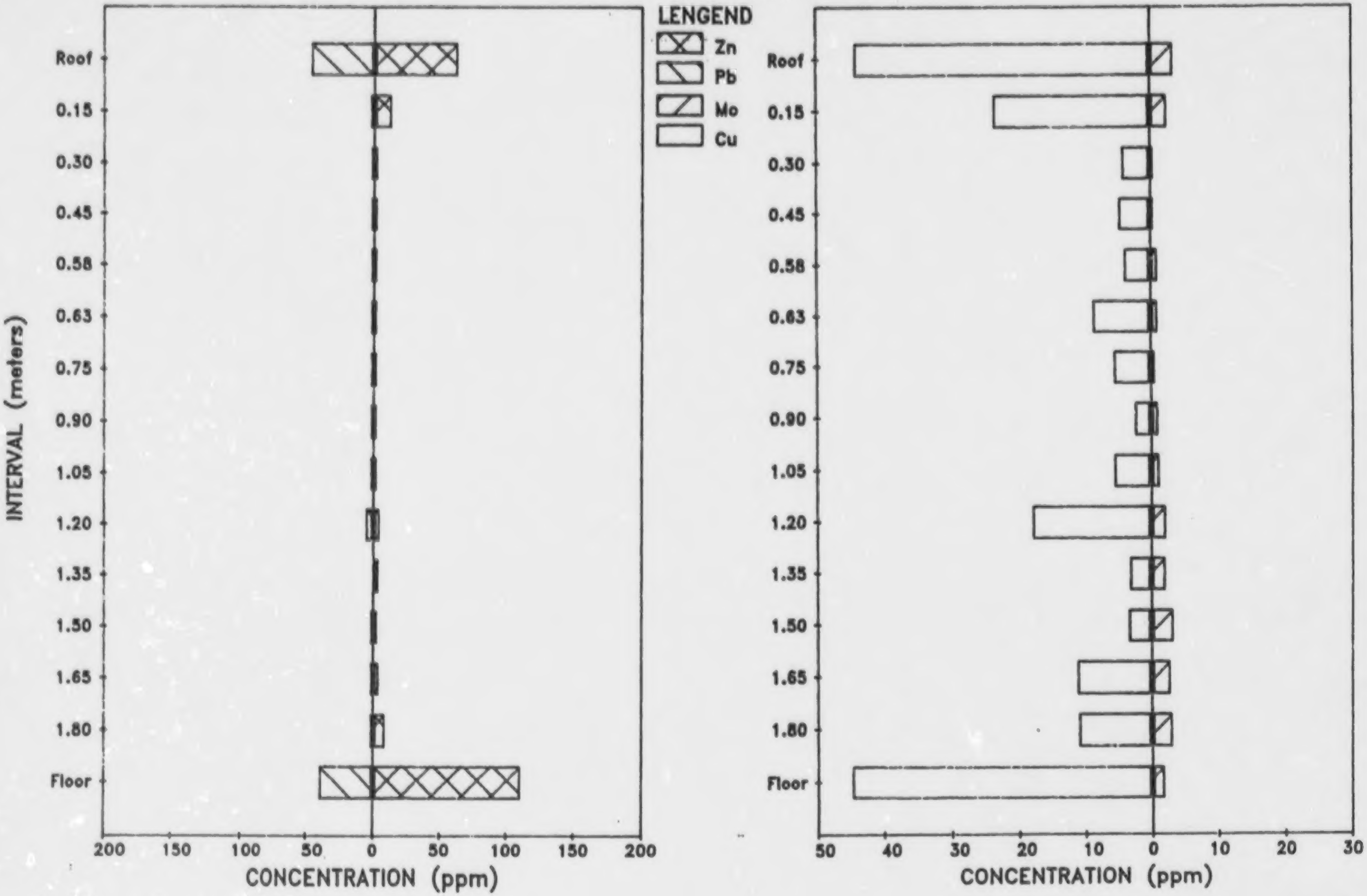


FIGURE II.19

HARBOUR SEAM – LINGAN MINE
Whole Coal – Cal.
Sandstone Roof

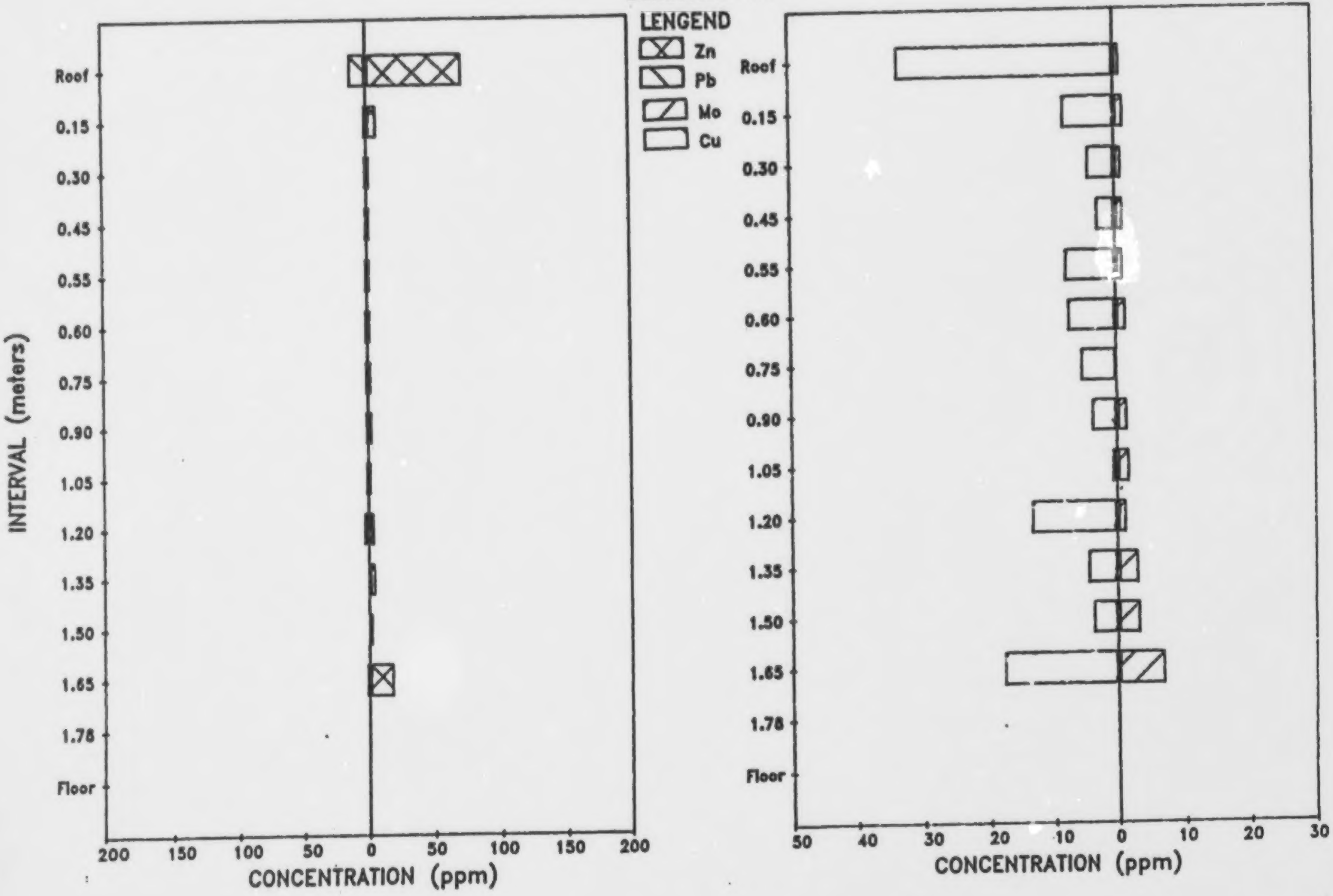


FIGURE II.20

PHALEN SEAM – PHALEN COLLIERY
Whole Coal – Cal.
Shale Roof

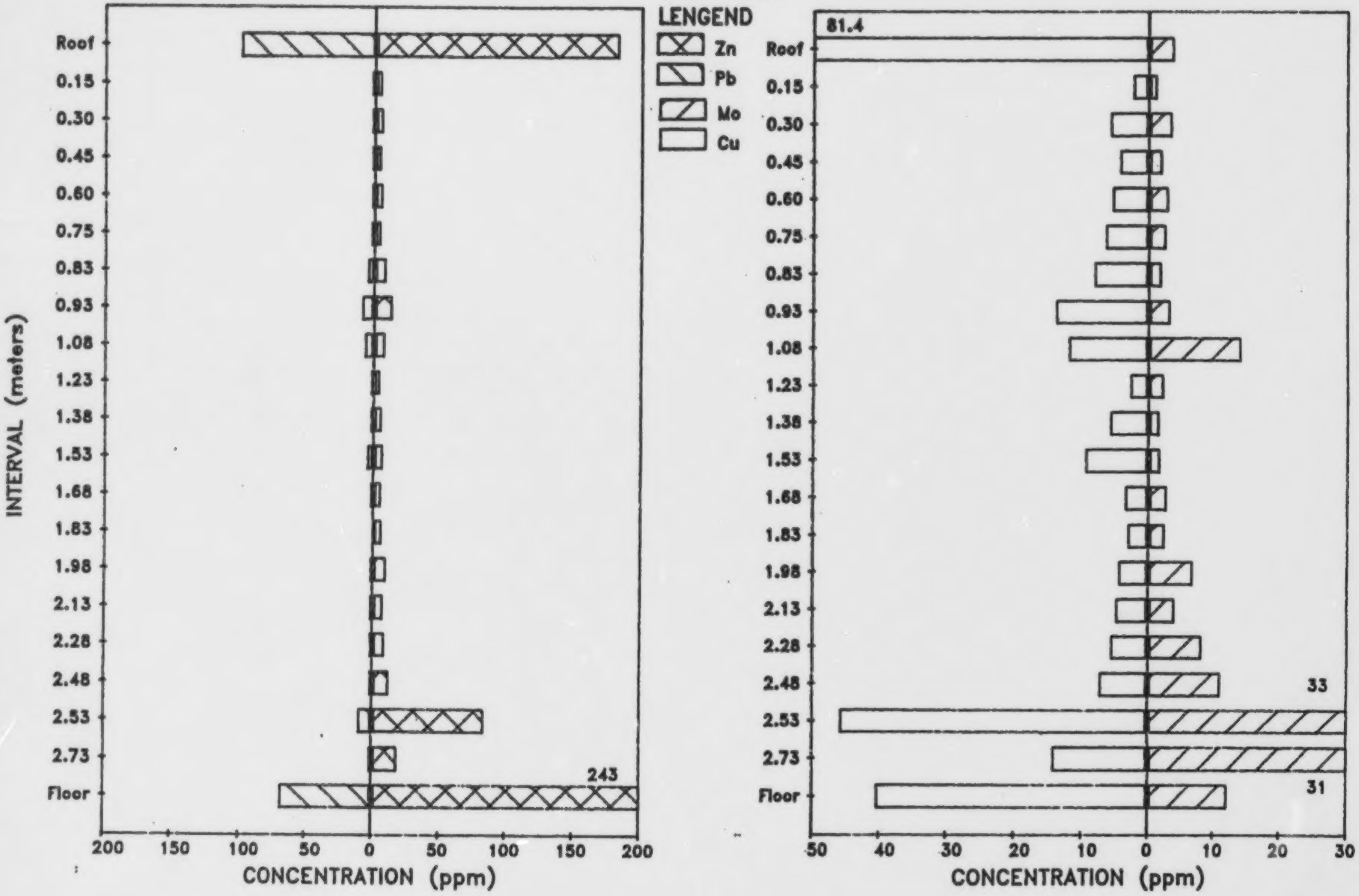
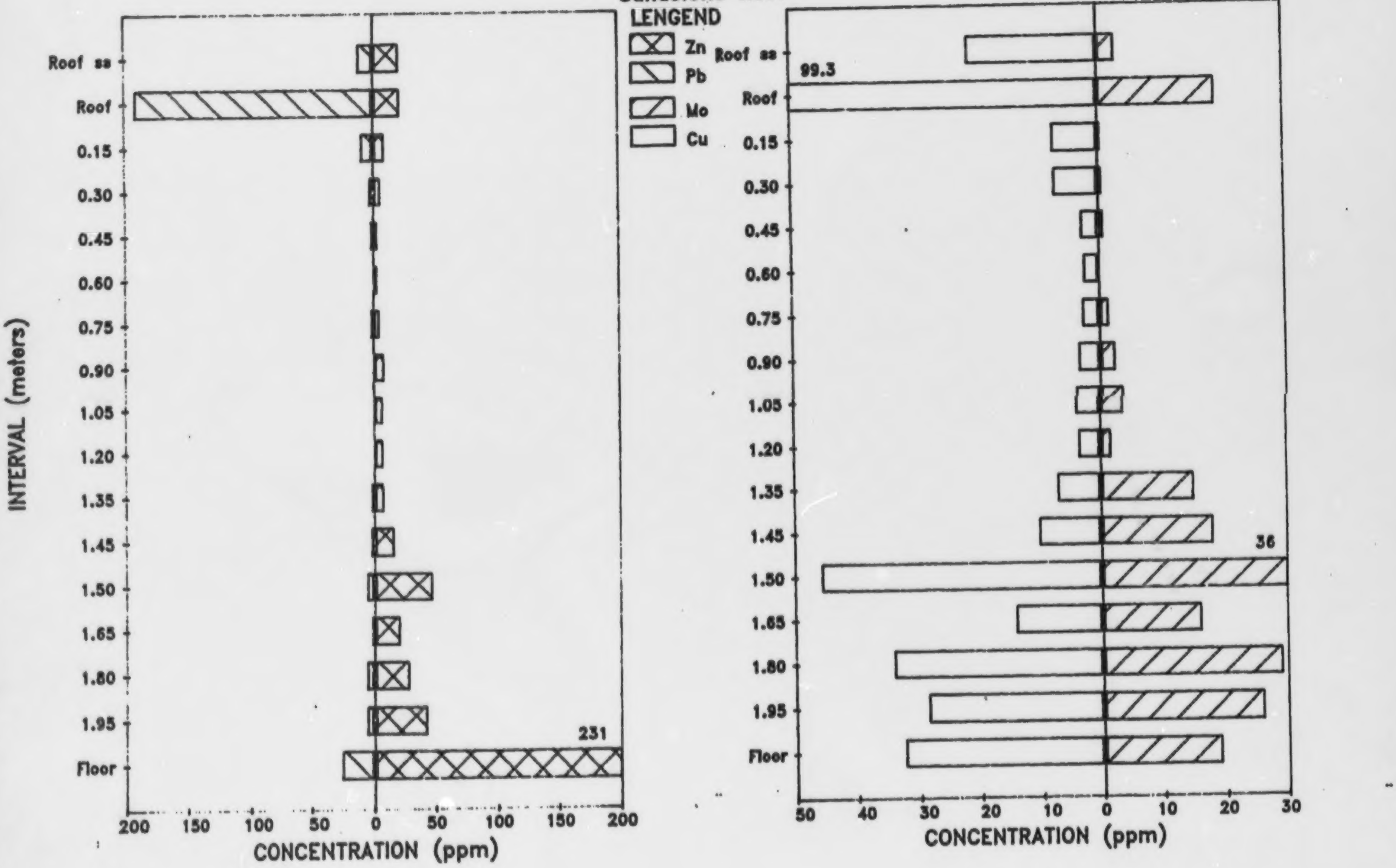


FIGURE II.21

PHALEN SEAM – PHALEN COLLIERY
Whole Coal – Cal.
Sandstone Roof



APPENDIX II C. MAJOR AND TRACE ELEMENT ANALYSIS

List of Figures
(Continued)

Variation in: Ni
Co
V
Cr
in whole coal

FIGURE II.22 Hub Seam - Shale Roof

FIGURE II.23 Hub Seam - Sandstone Roof

FIGURE II.24 Harbour Seam - Shale Roof

FIGURE II.25 Harbour Seam - Sandstone Roof

FIGURE II.26 Phalen Seam - Shale Roof

FIGURE II.27 Phalen Seam - Sandstone Roof

FIGURE II.22

HUB SEAM – PRINCE MINE
Whole Coal – Cal.
Shale Roof

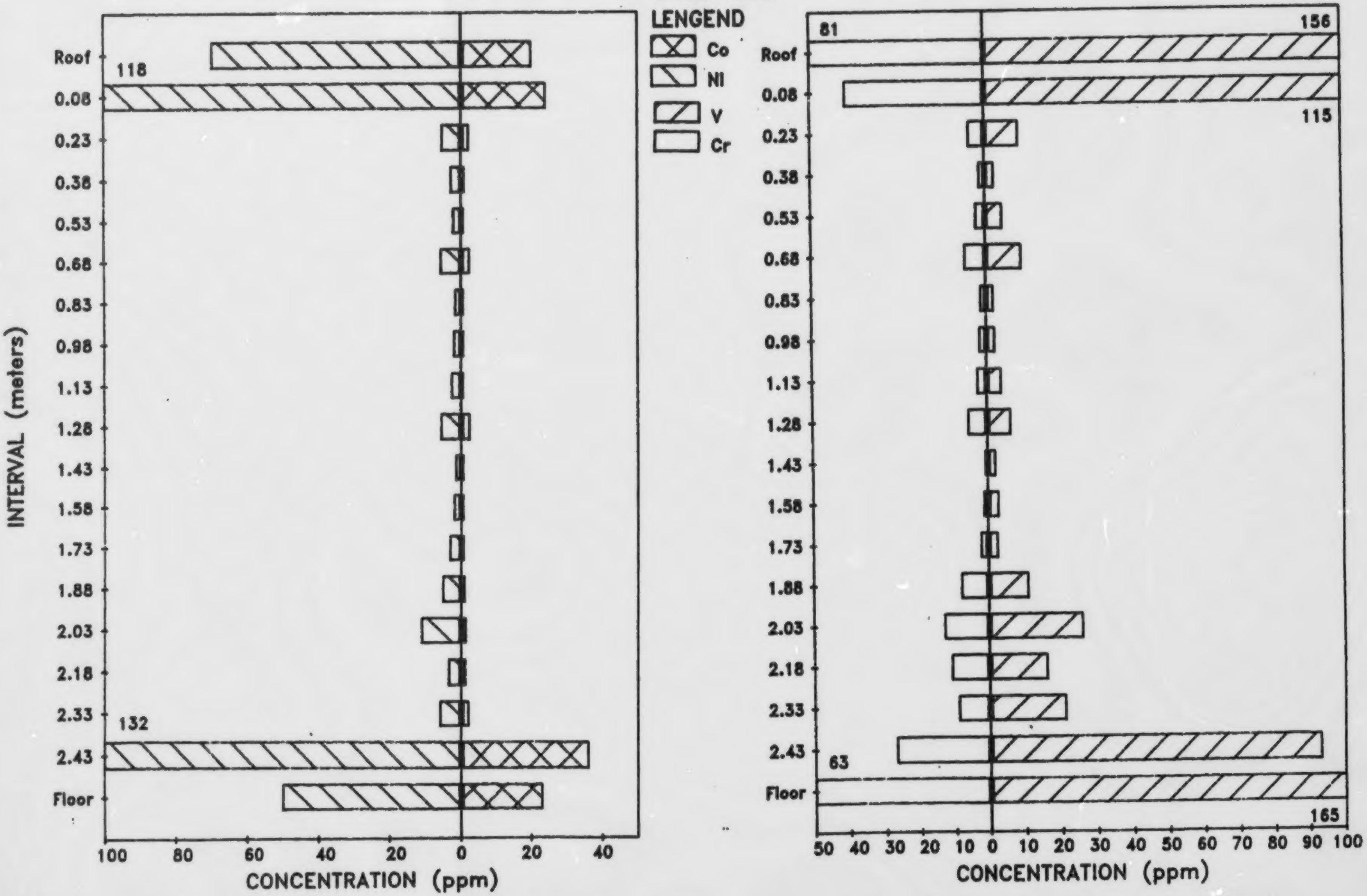


FIGURE II.23

HUB SEAM – PRINCE MINE

Whole Coal – Cal.

Sandstone Roof

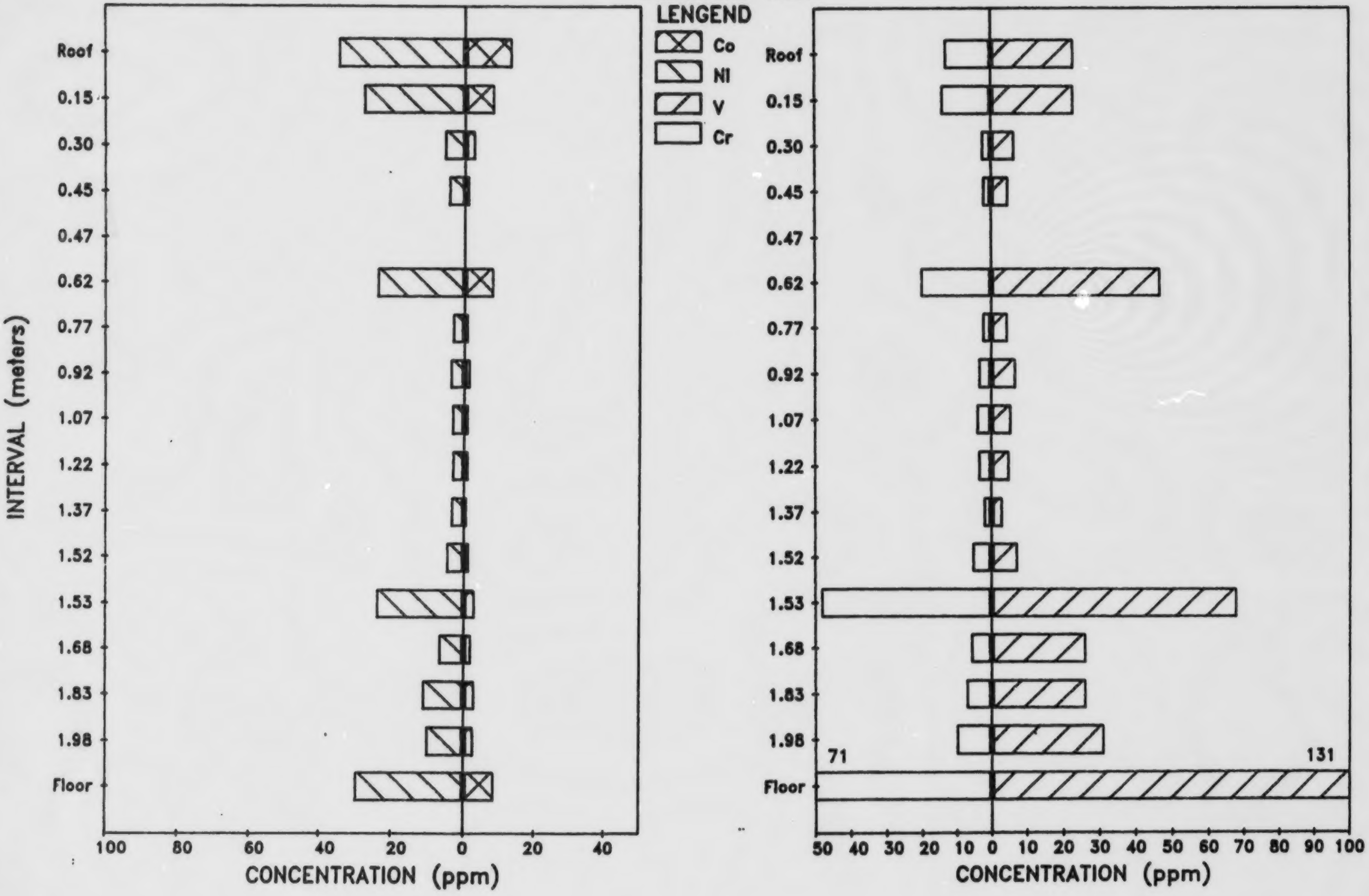


FIGURE II.24

HARBOUR SEAM – LINGAN MINE
Whole Coal – Cal.
Shale Roof

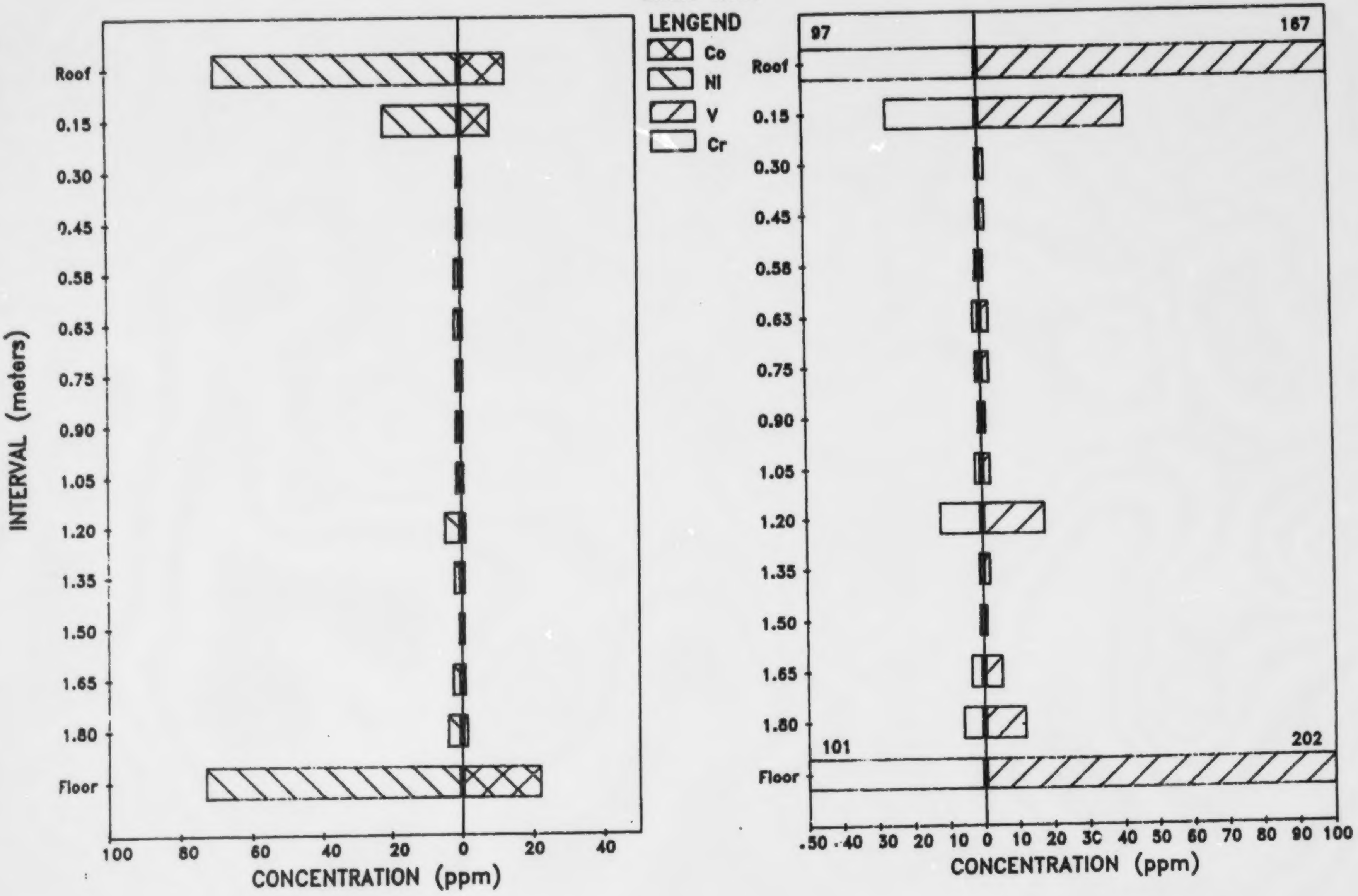


FIGURE II.25

HARBOUR SEAM – LINGAN MINE

Whole Coal – Cal.

Sandstone Roof

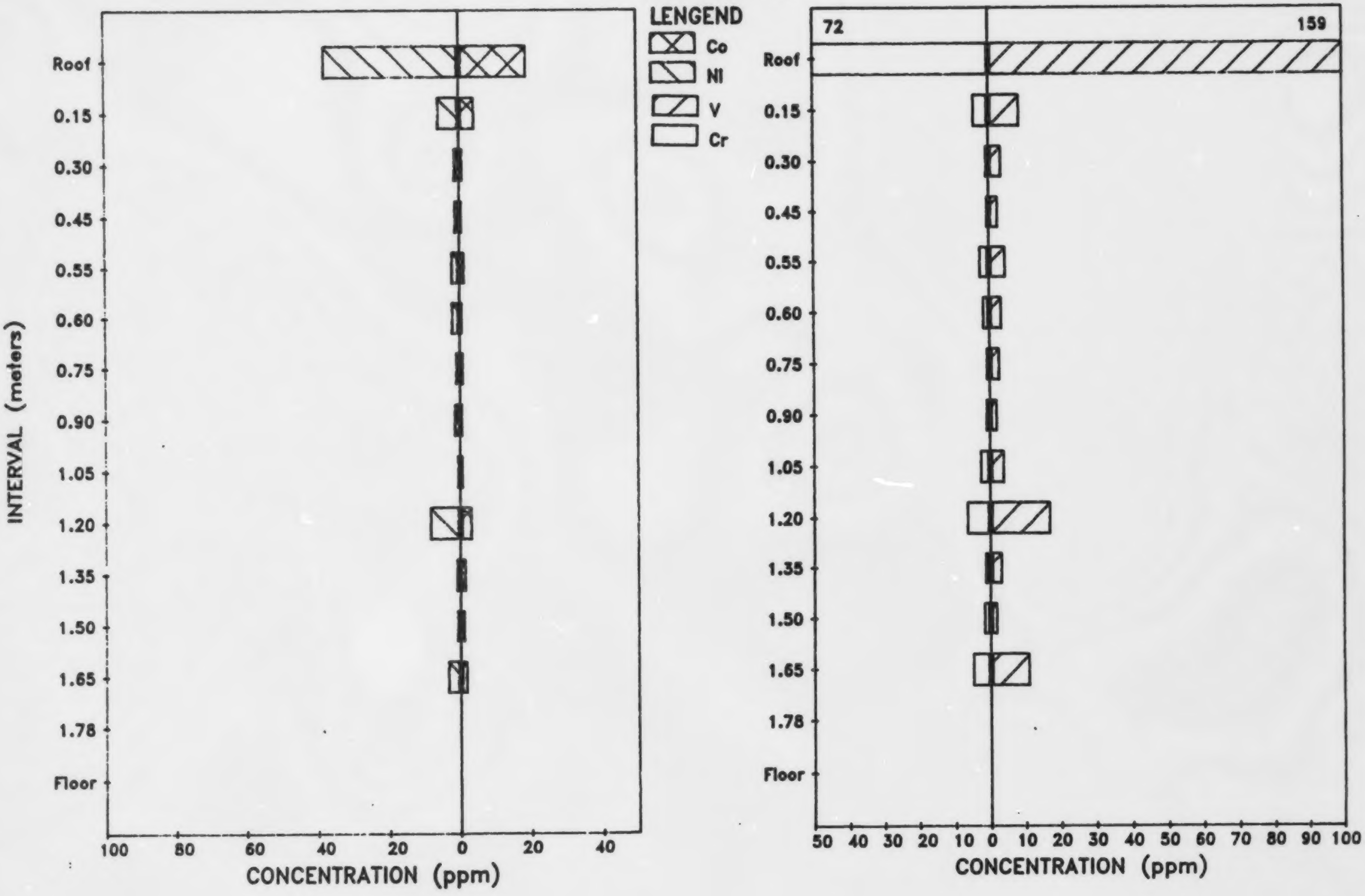


FIGURE II.26

PHALEN SEAM — PHALEN COLLIERY
Whole Coal — Cal.
Shale Roof

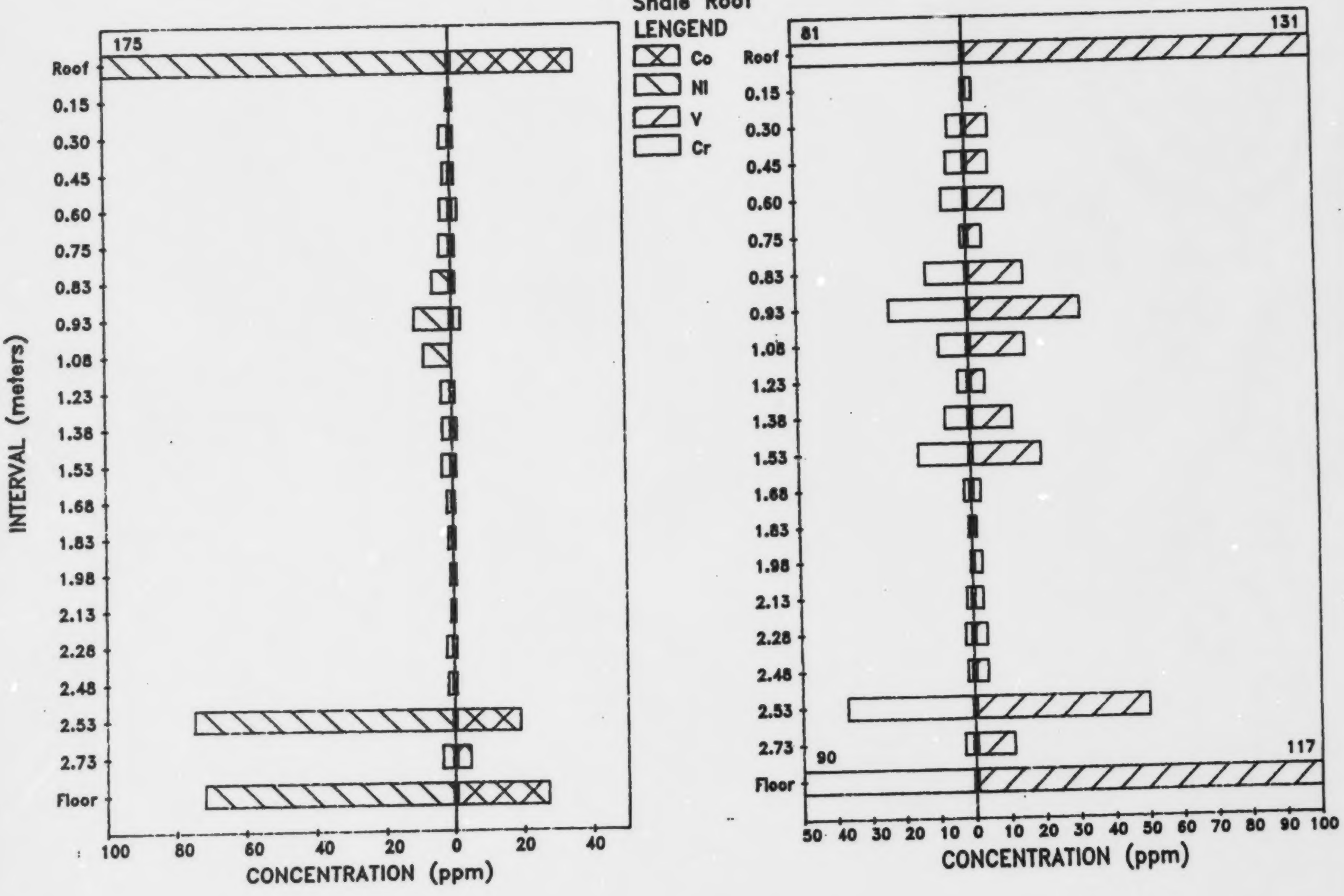
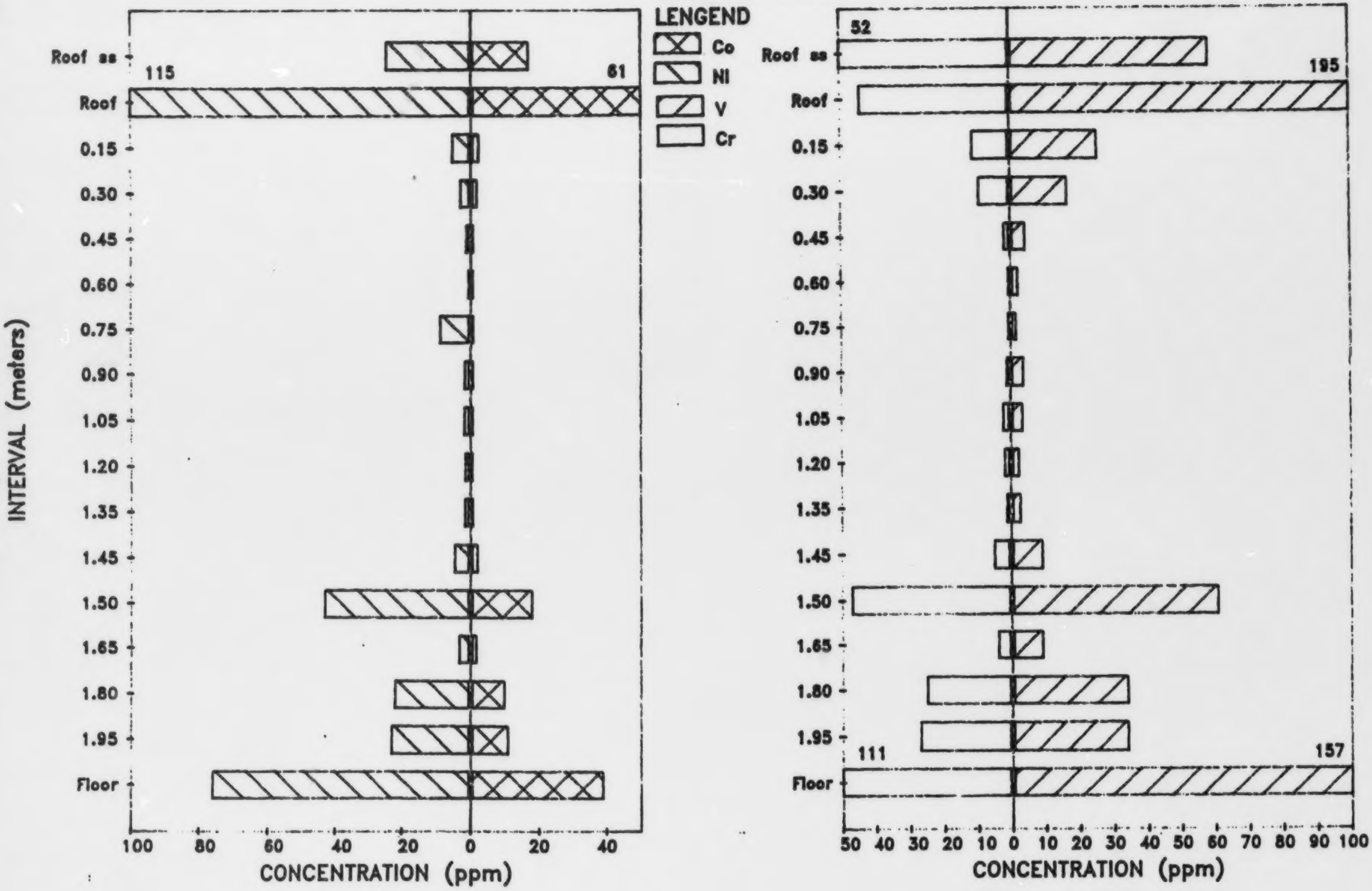


FIGURE II.27

PHALEN SEAM – PHALEN COLLIERY
Whole Coal – Cal.
Sandstone Roof



APPENDIX II.C MAJOR AND TRACE ELEMENT ANALYSIS

List of Figures
(Continued)

Variation in: Rb
Sr
P
Ba
in whole coal

FIGURE II.28 Hub Seam - Shale Roof

FIGURE II.29 Hub Seam - Sandstone Roof

FIGURE II.30 Harbour Seam - Shale Roof

FIGURE II.31 Harbour Seam - Sandstone Roof

FIGURE II.32 Phalen Seam - Shale Roof

FIGURE II.33 Phalen Seam - Sandstone Roof

FIGURE II.28
HUB SEAM – PRINCE MINE
Whole Coal – Cal.
Shale Roof

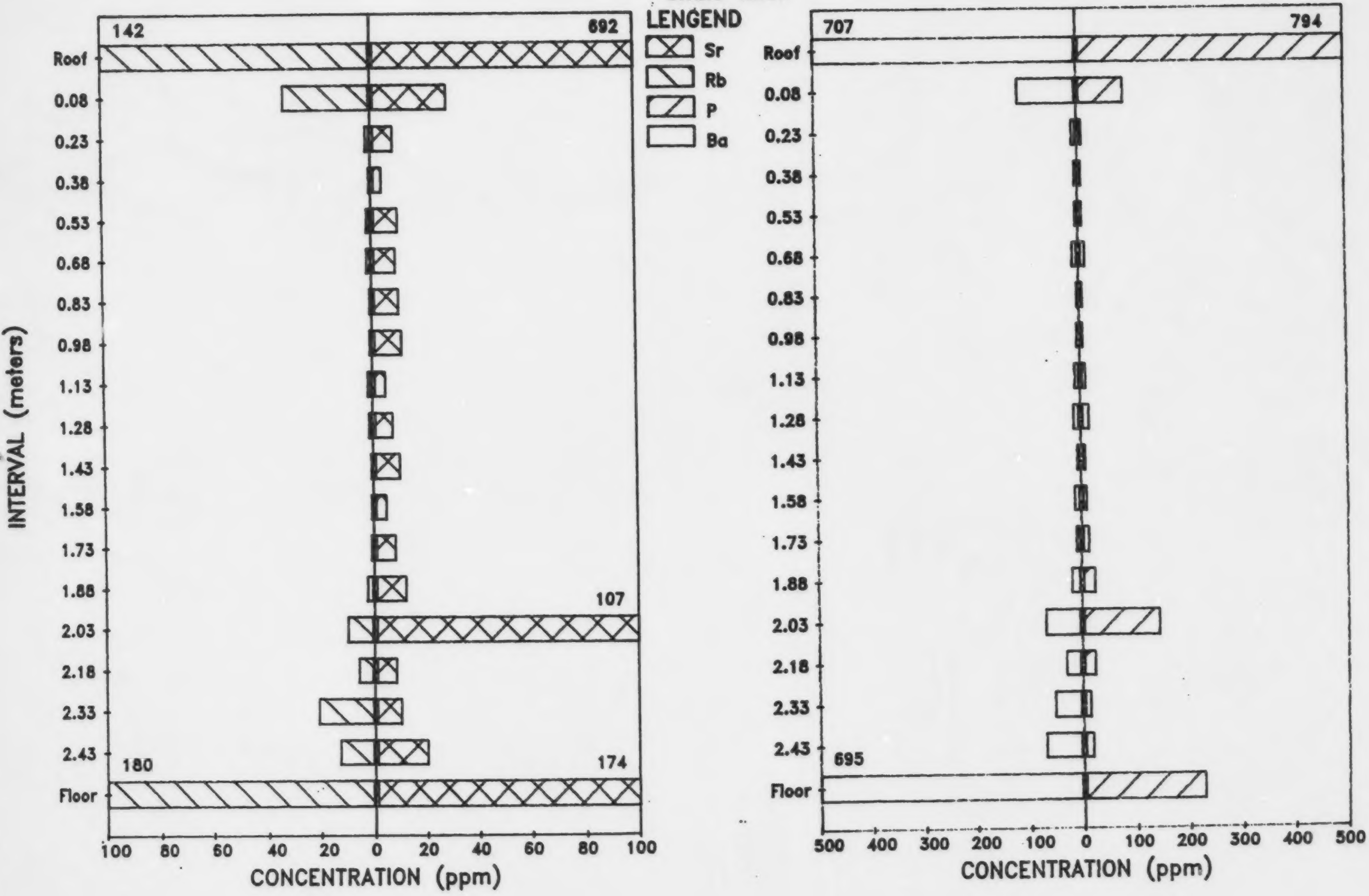


FIGURE II.29

HUB SEAM – PRINCE MINE

Whole Coal – Cal.

Sandstone Roof

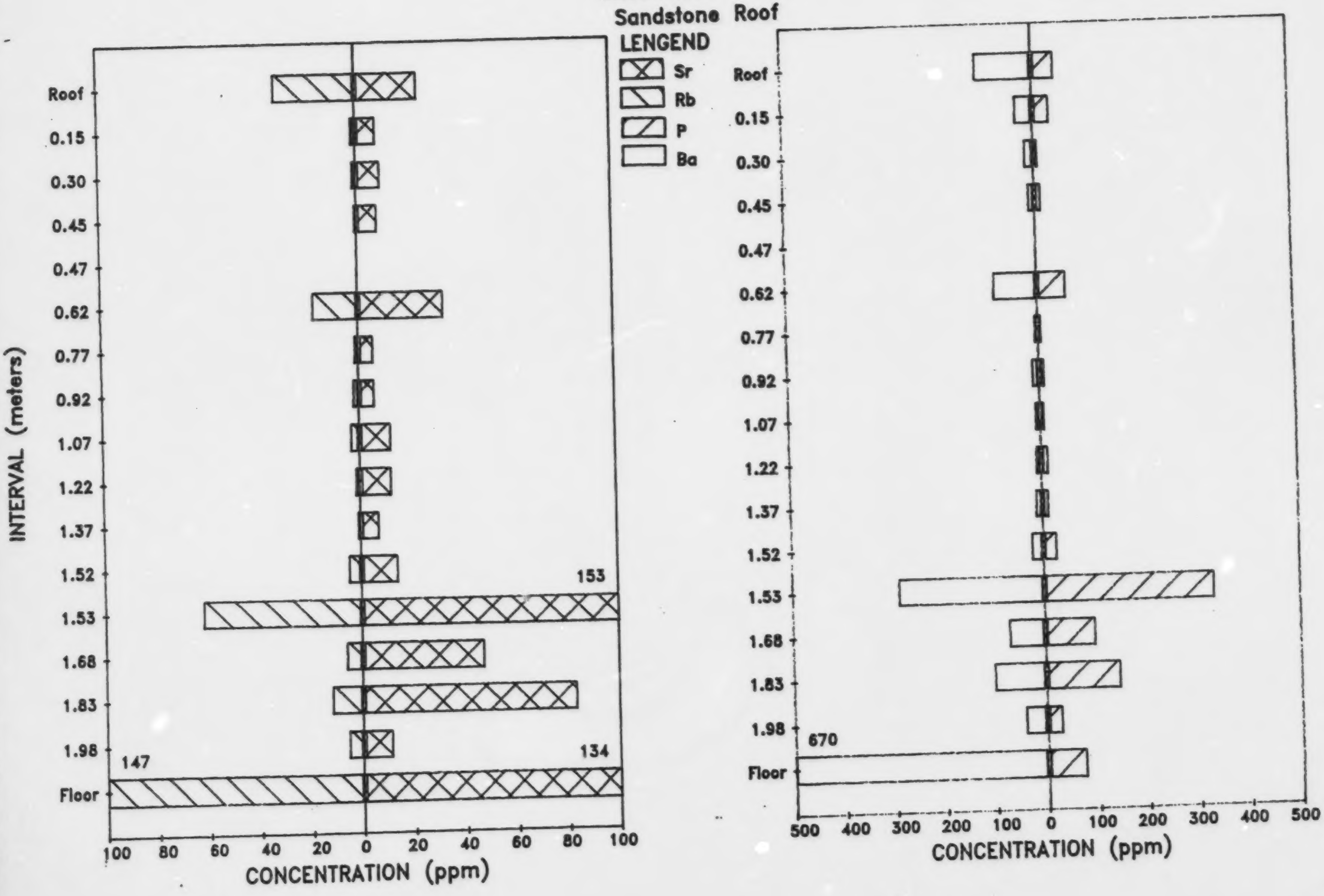


FIGURE II.30

HARBOUR SEAM – LINGAN MINE

Whole Coal – Cal.

Shale Roof

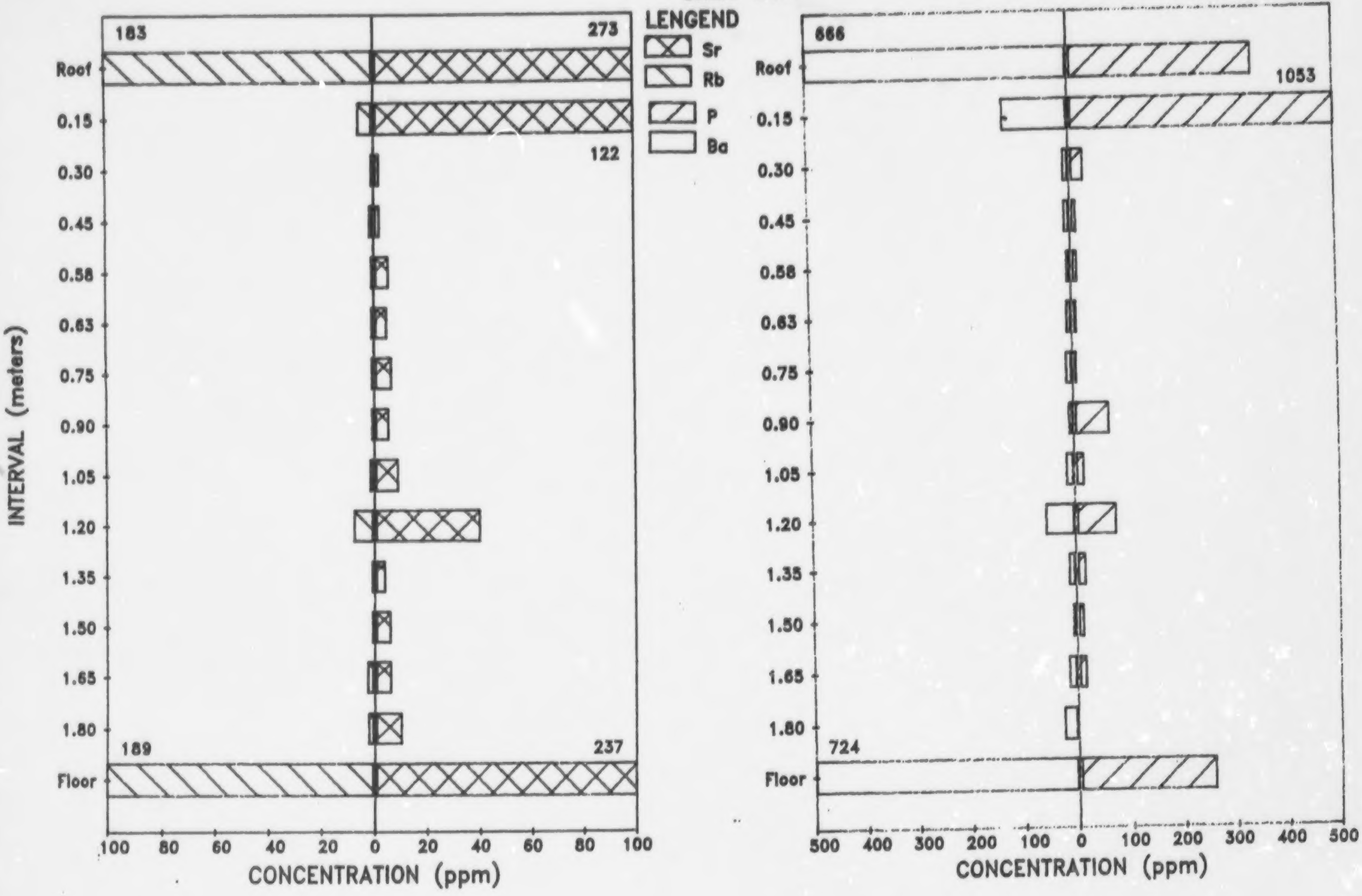


FIGURE II.31

HARBOUR SEAM – LINGAN MINE
Whole Coal – Cal.
Sandstone Roof

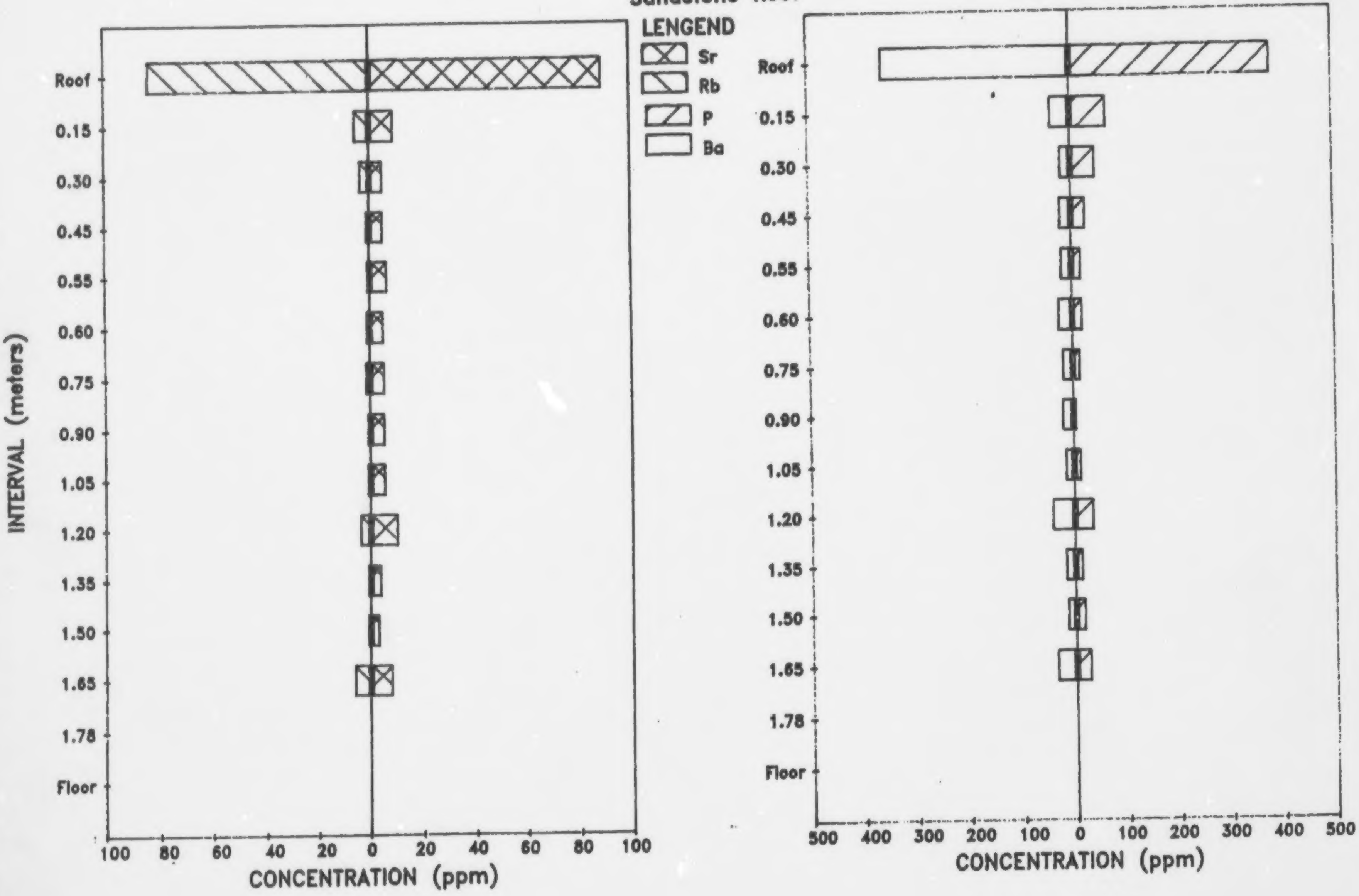


FIGURE II.32

PHALEN SEAM – PHALEN COLLIERY

Whole Coal – Cal.

Shale Roof

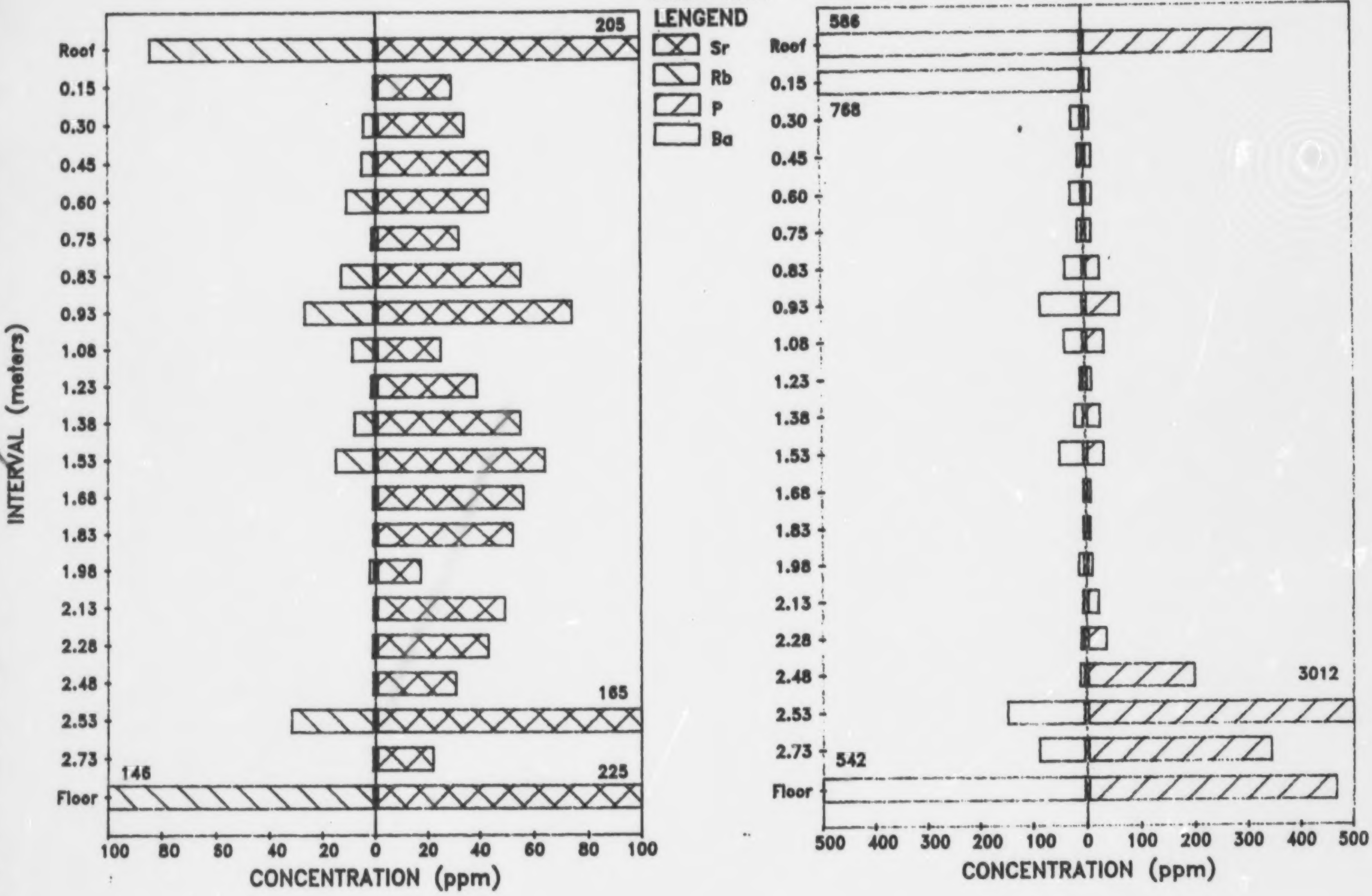
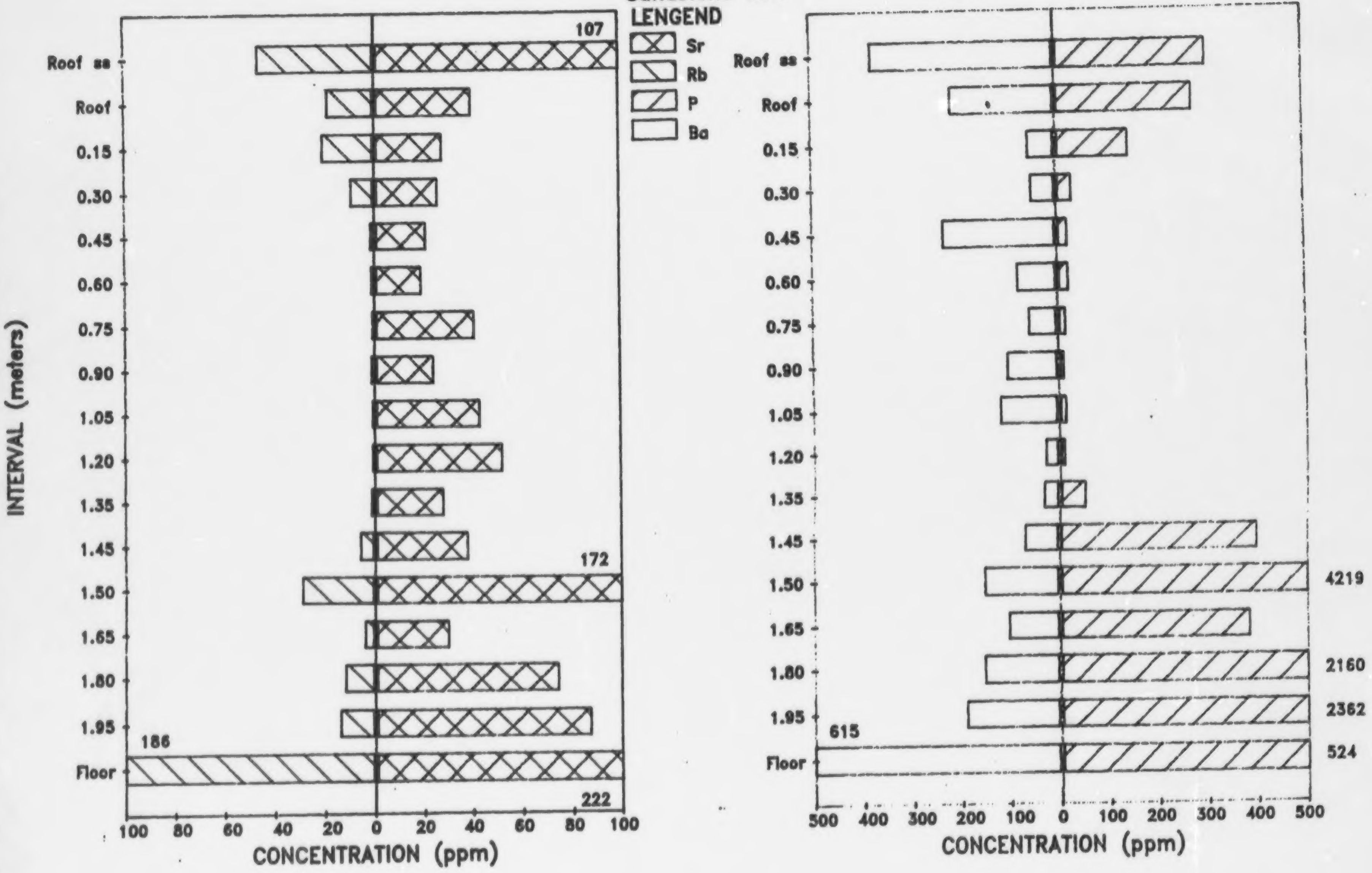


FIGURE II.33

PHALEN SEAM – PHALEN COLLIERY
Whole Coal – Cal.
Sandstone Roof



APPENDIX II C. MAJOR AND TRACE ELEMENT ANALYSIS

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Variation in: Ga
Ge
in whole coal

FIGURE II.34 Hub Seam - Shale; Sandstone Roof

FIGURE II.35 Harbour Seam - Shale; Sandstone Roof

FIGURE II.36 Phalen Seam - Shale; Sandstone Roof

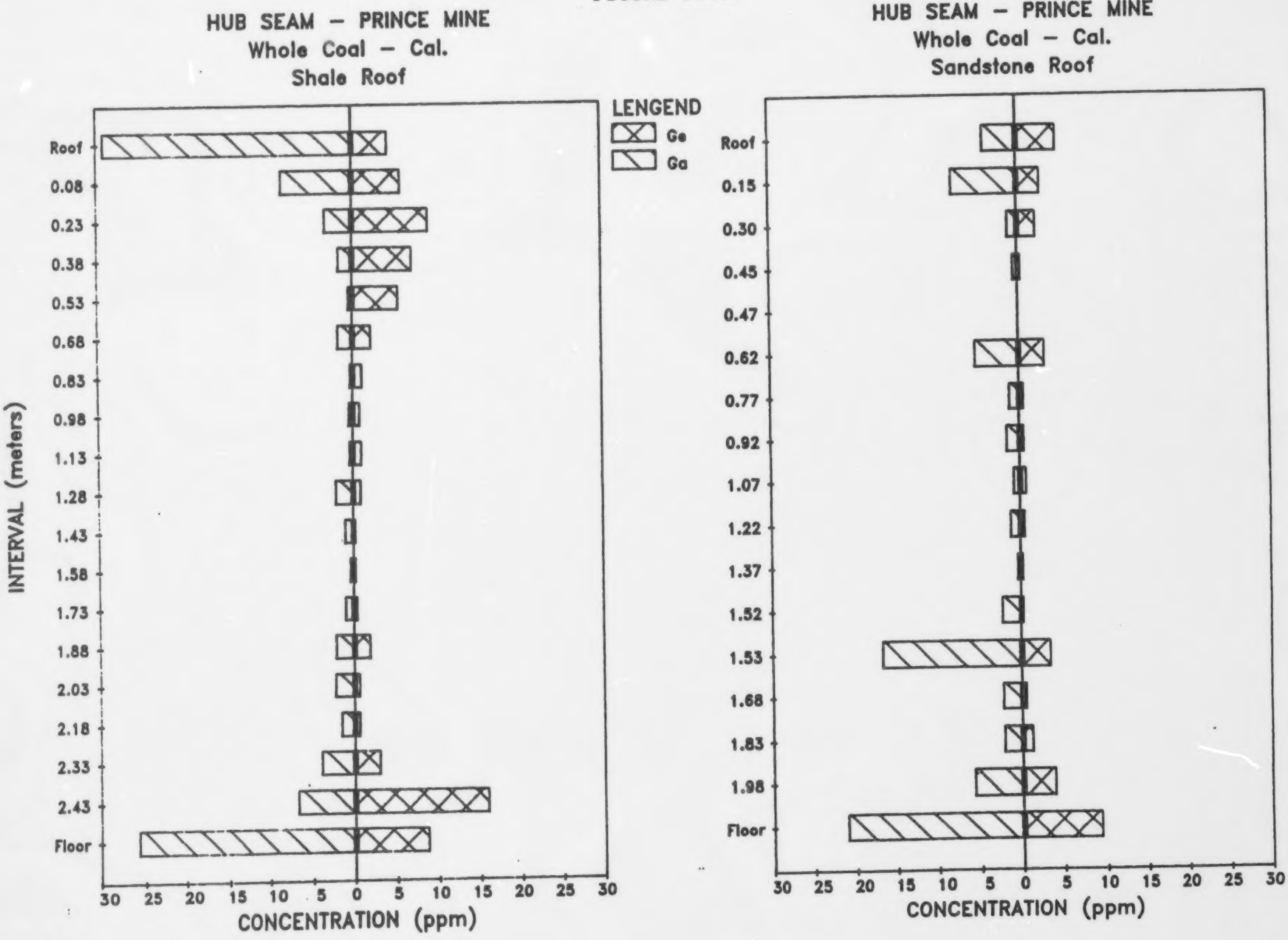
Variation in: Ga
Ge
in ash

FIGURE II.37 Hub Seam - Shale; Sandstone Roof

FIGURE II.38 Harbour Seam - Shale; Sandstone Roof

FIGURE II.39 Phalen Seam - Shale; Sandstone Roof

FIGURE II.34



HUB SEAM – PRINCE MINE
Whole Coal – Cal.
Shale Roof

HUB SEAM – PRINCE MINE
Whole Coal – Cal.
Sandstone Roof

FIGURE II.35

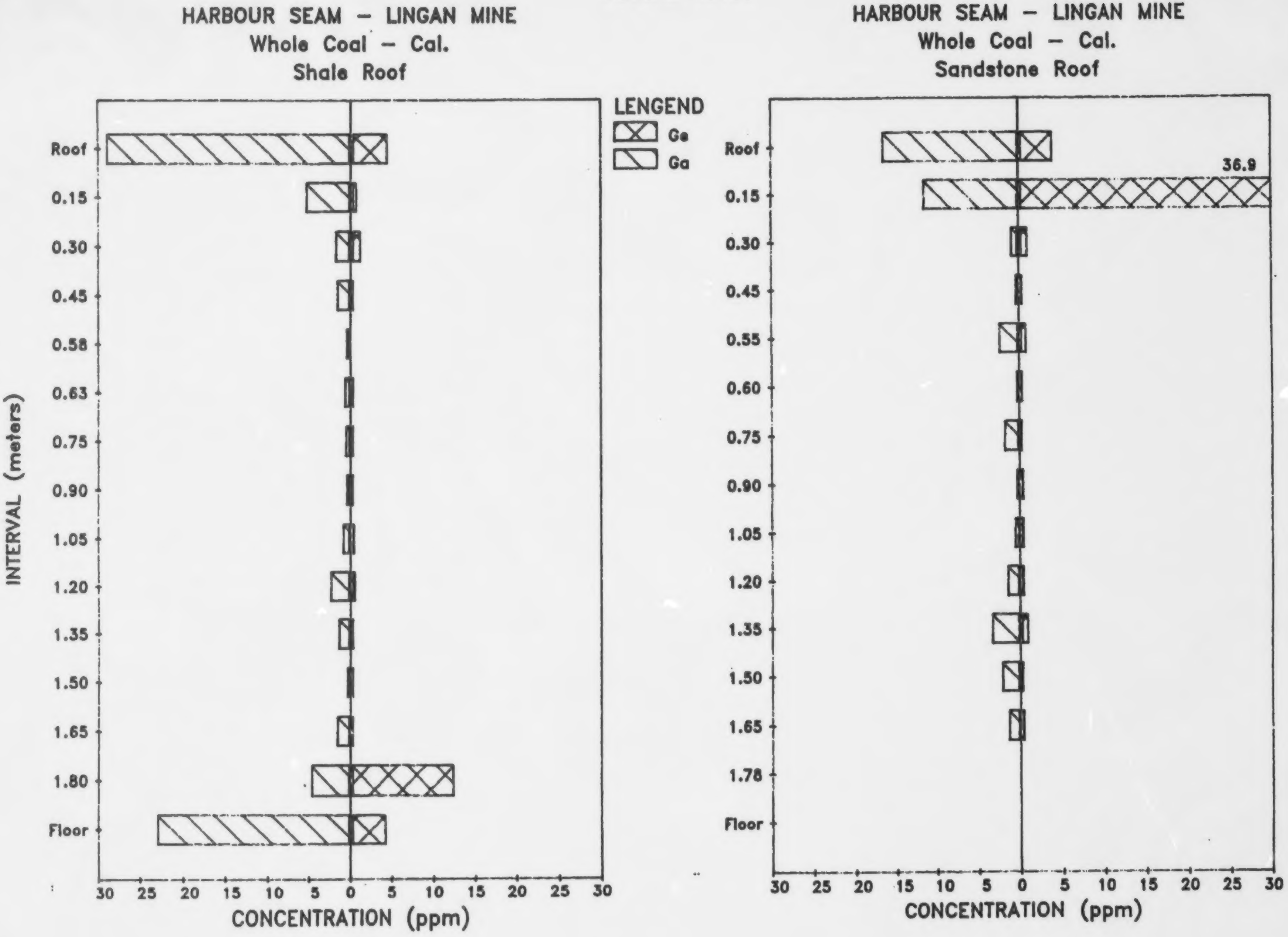
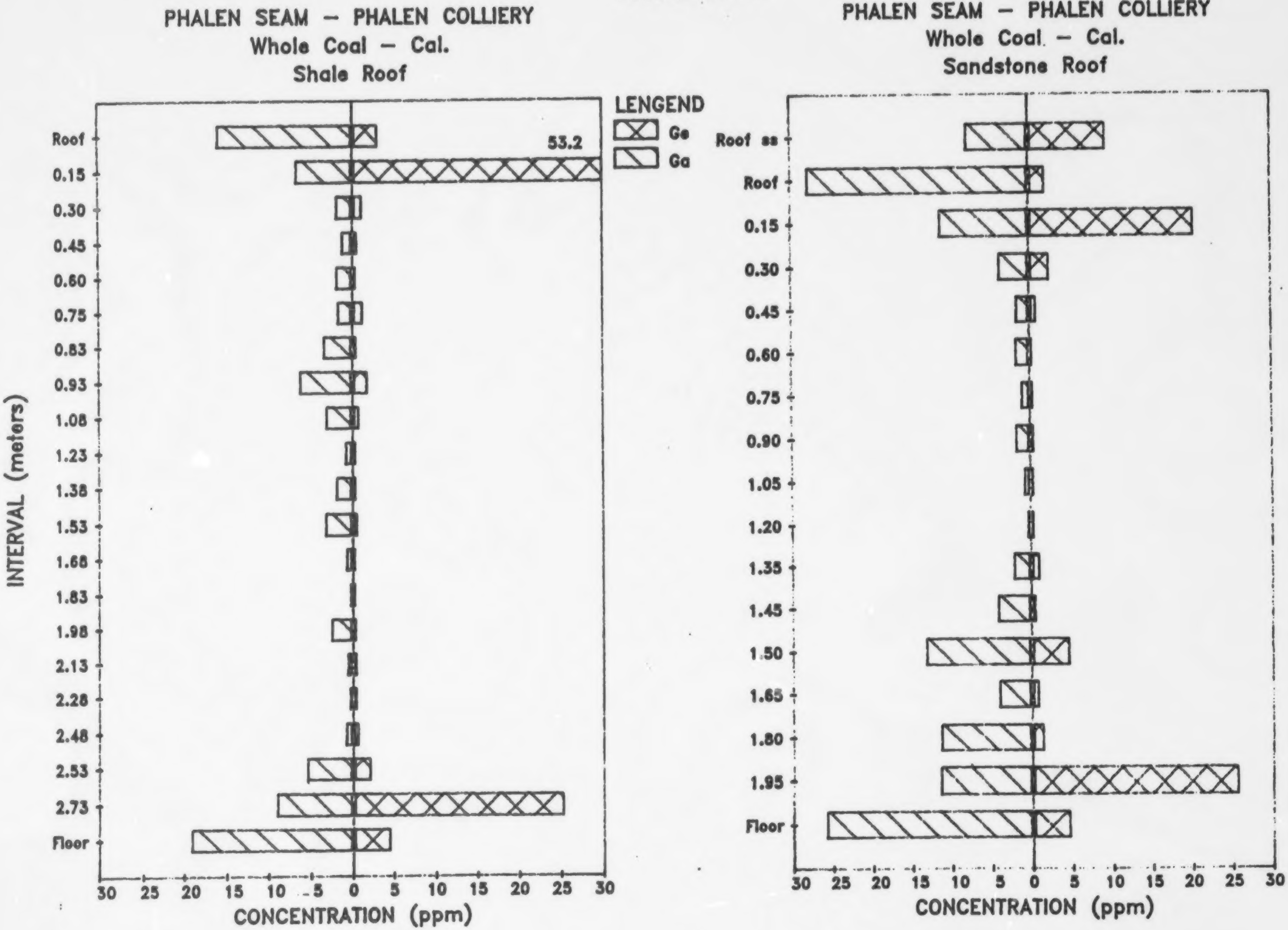

HARBOUR SEAM – LINGAN MINE
Whole Coal – Cal.
Shale Roof
LENGEND
Ge
Ga
HARBOUR SEAM – LINGAN MINE
Whole Coal – Cal.
Sandstone Roof
INTERVAL (meters)
Roof
0.15
0.30
0.45
0.58
0.63
0.75
0.90
1.05
1.20
1.35
1.50
1.65
1.80
Floor
Roof
0.15
0.30
0.45
0.55
0.60
0.75
0.90
1.05
1.20
1.35
1.50
1.65
1.78
Floor
36.9
30 25 20 15 10 5 0 5 10 15 20 25 30
CONCENTRATION (ppm)
30 25 20 15 10 5 0 5 10 15 20 25 30
CONCENTRATION (ppm)

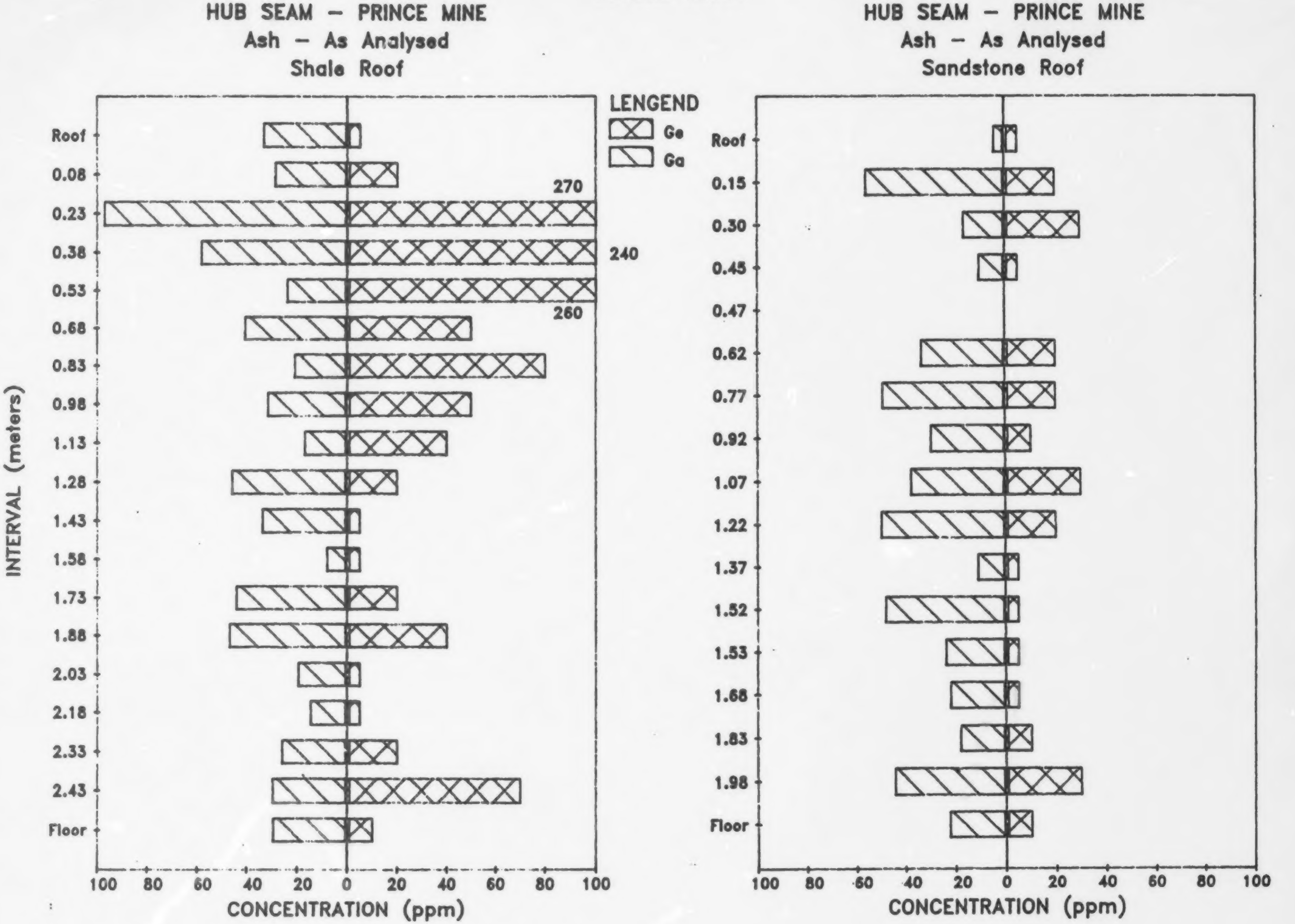
FIGURE II.36



PHALEN SEAM – PHALEN COLLIERY
Whole Coal – Cal.
Shale Roof

PHALEN SEAM – PHALEN COLLIERY
Whole Coal – Cal.
Sandstone Roof

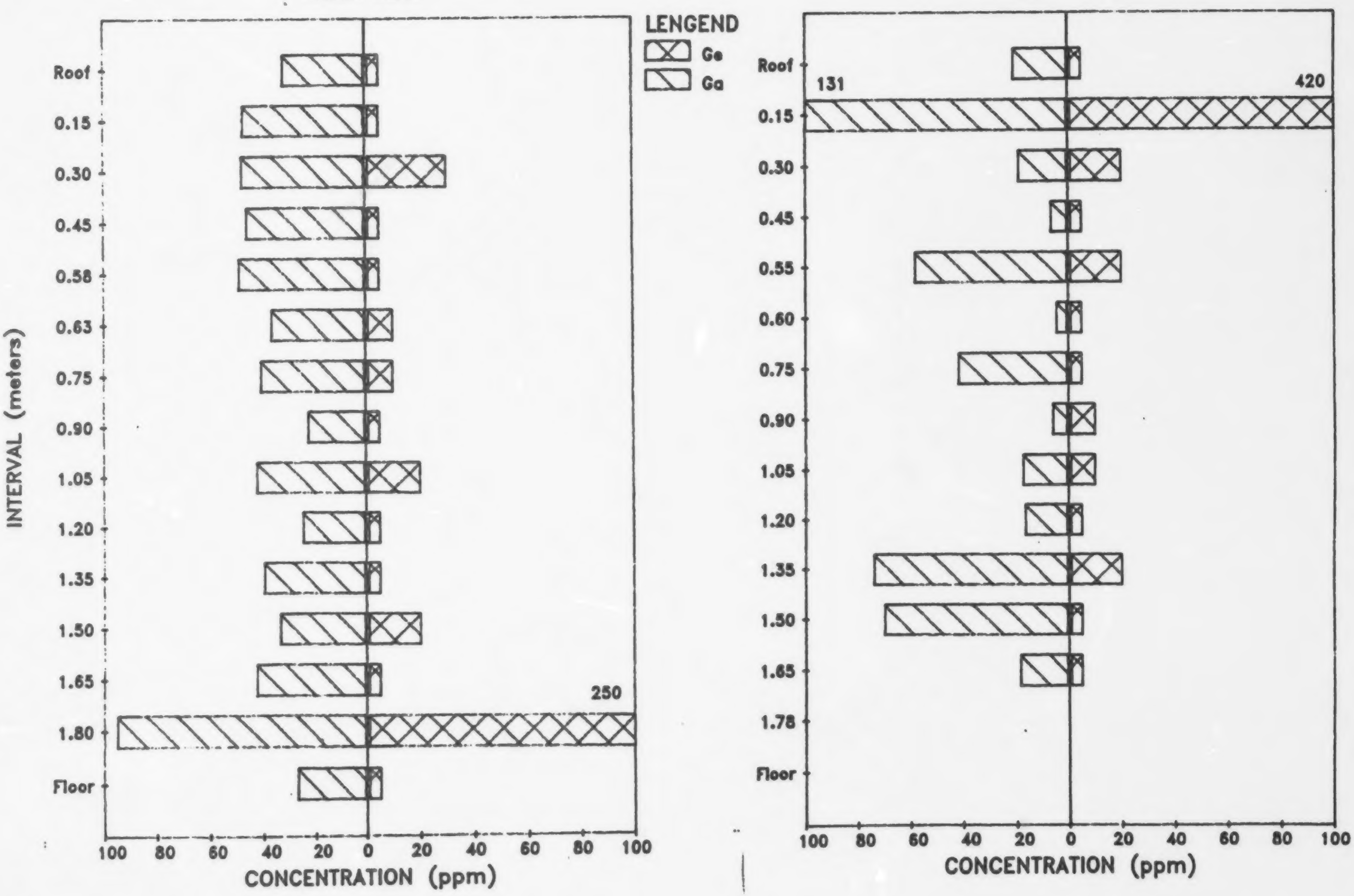
FIGURE II.37



HUB SEAM – PRINCE MINE
Ash – As Analysed
Shale Roof

HUB SEAM – PRINCE MINE
Ash – As Analysed
Sandstone Roof

FIGURE II.38



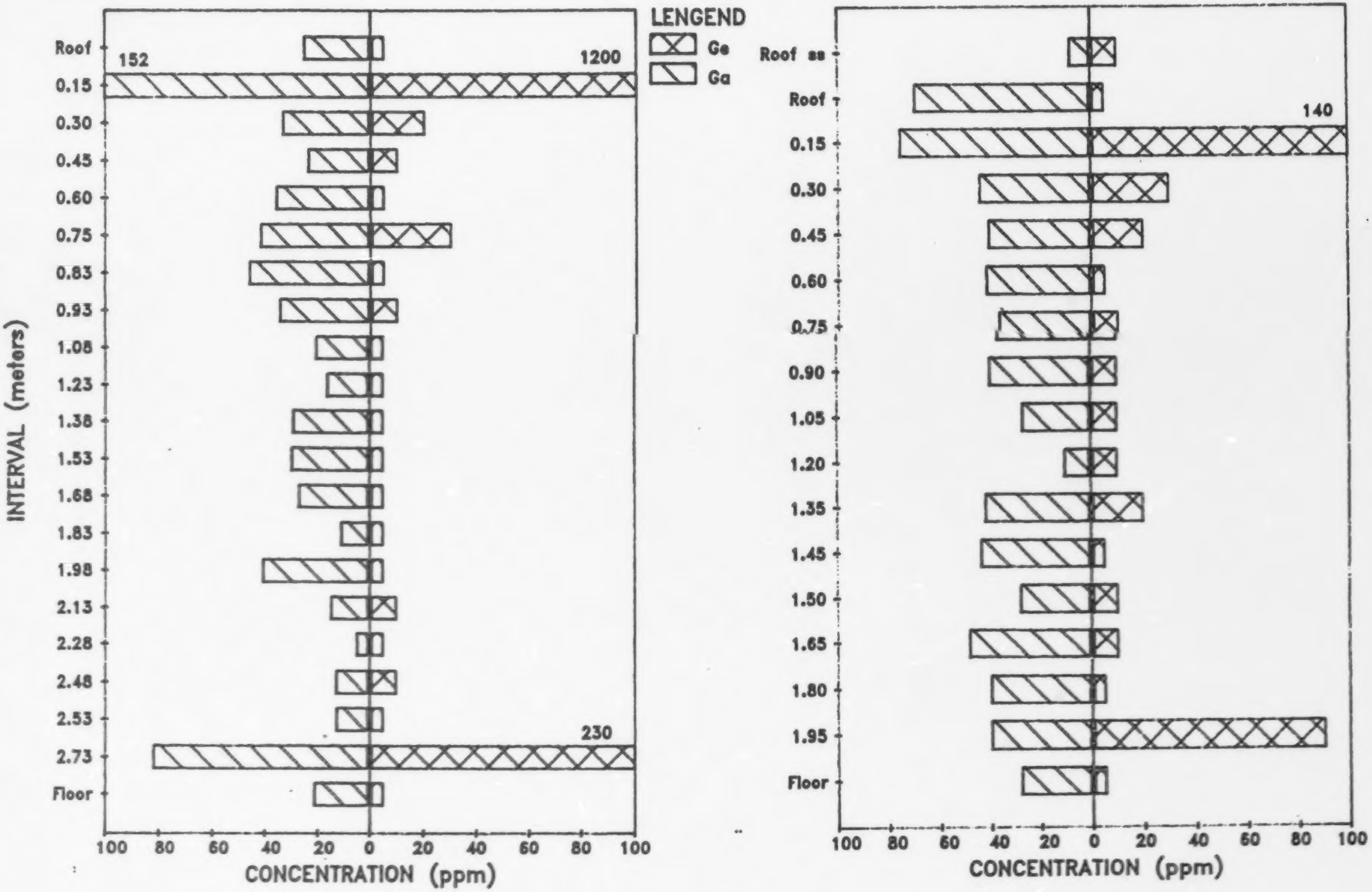
HARBOUR SEAM – LINGAN MINE
Ash – As Analysed
Shale Roof

HARBOUR SEAM – LINGAN MINE
Ash – As Analysed
Sandstone Roof

FIGURE II.39

PHALEN SEAM – PHALEN COLLIERY
Ash – As Analysed
Shale Roof

PHALEN SEAM – PHALEN COLLIERY
Ash – As Analysed
Sandstone Roof



APPENDIX II C. MAJOR AND TRACE ELEMENT ANALYSIS

List of Figures
(Continued)

Variation in: As
Hg
S
in whole coal

FIGURE II.40 Hub Seam - Shale; Sandstone Roof

FIGURE II.41 Harbour Seam - Shale; Sandstone Roof

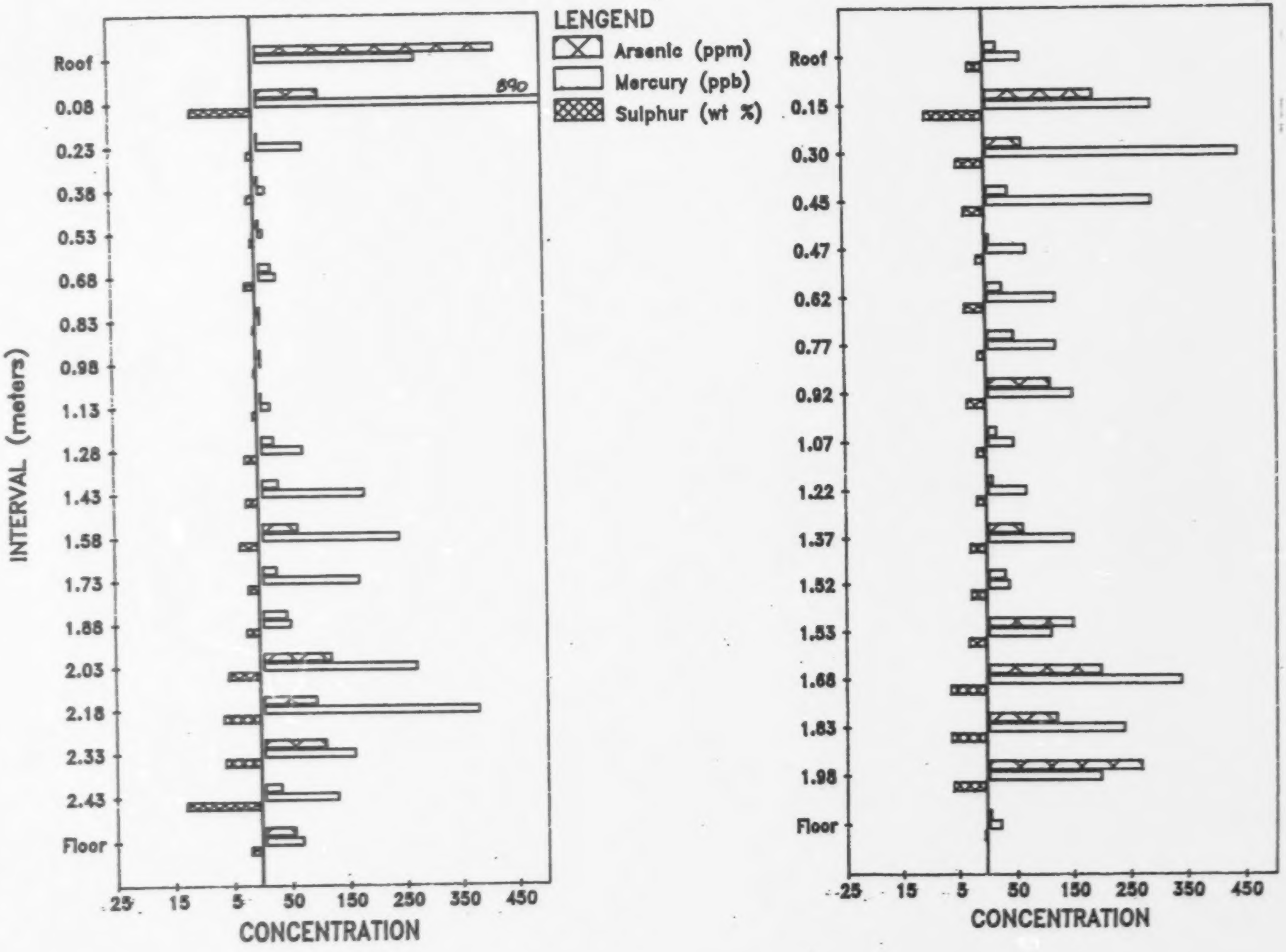
FIGURE II.42 Phalen Seam - Shale; Sandstone Roof

Rare Earth - Chondrite Plots

FIGURE II.43 Seam Average - Shale Roof

FIGURE II.44 Seam Average - Sandstone Roof

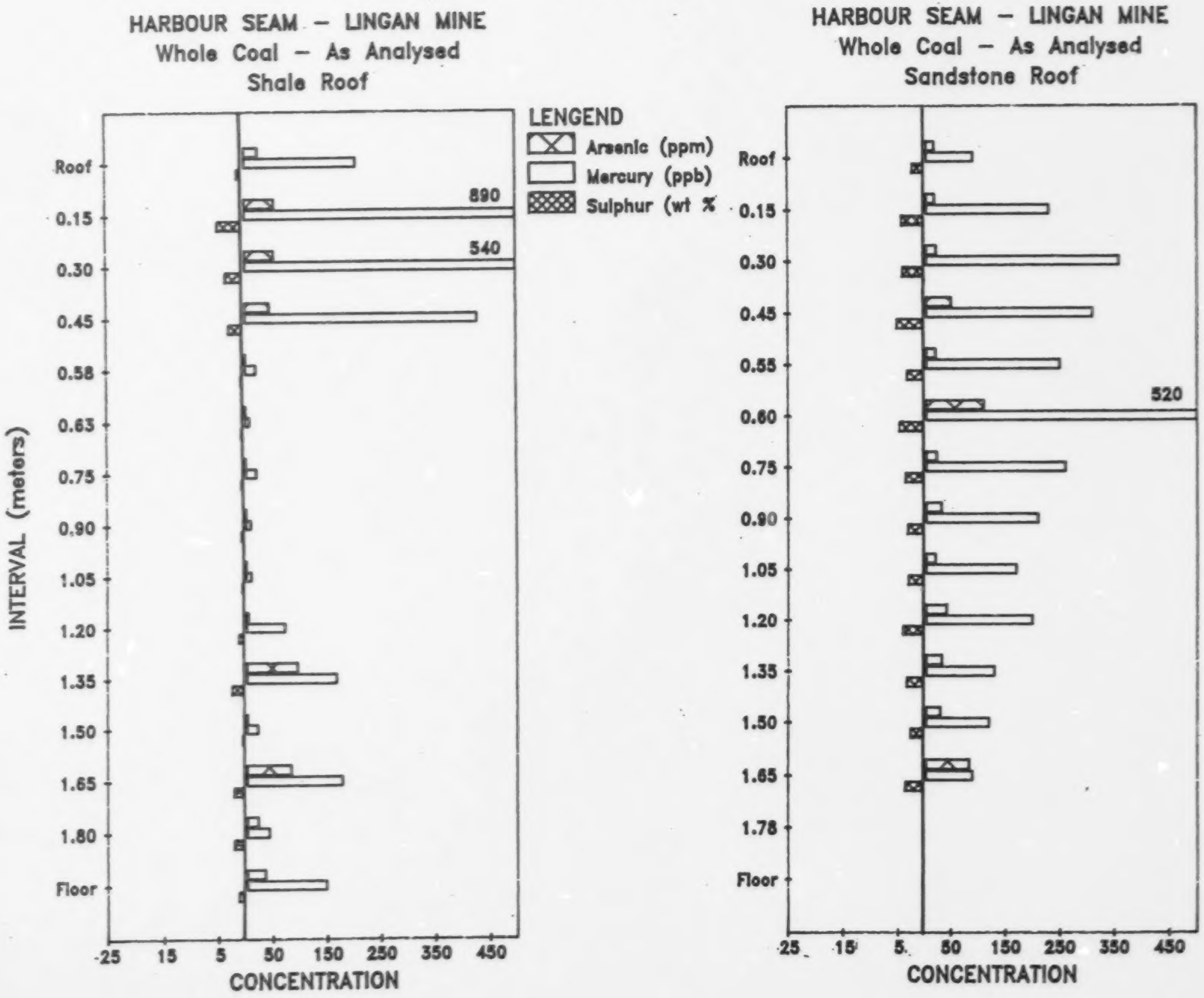
FIGURE II.40



HUB SEAM – PRINCE MINE
Whole Coal – As Analysed
Shale Roof

HUB SEAM – PRINCE MINE
Whole Coal – As Analysed
Sandstone Roof

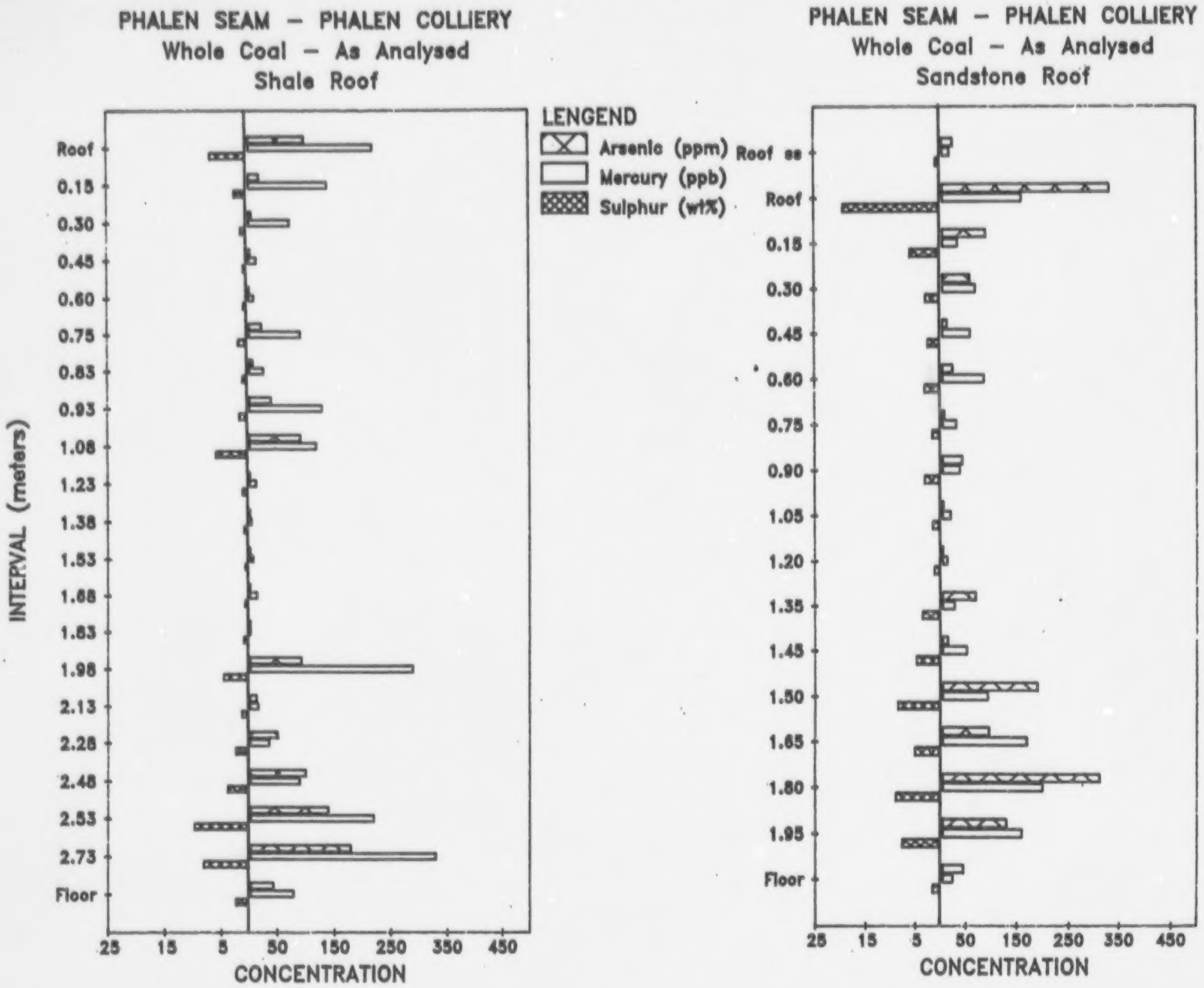
FIGURE II.41



HARBOUR SEAM – LINGAN MINE
Whole Coal – As Analysed
Shale Roof

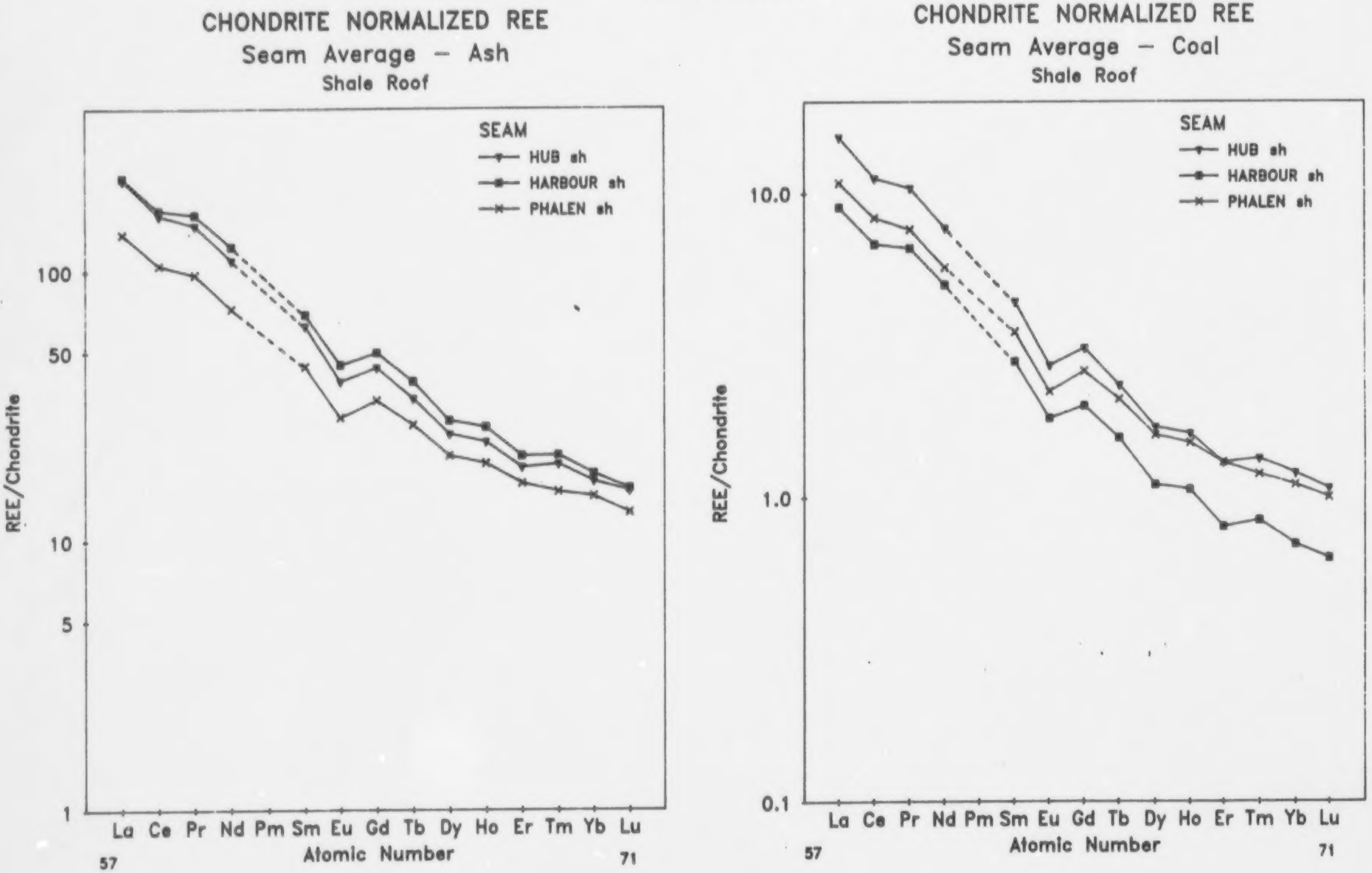
HARBOUR SEAM – LINGAN MINE
Whole Coal – As Analysed
Sandstone Roof

FIGURE II.42


PHALEN SEAM – PHALEN COLLIERY
Whole Coal – As Analysed
Shale Roof

PHALEN SEAM – PHALEN COLLIERY
Whole Coal – As Analysed
Sandstone Roof

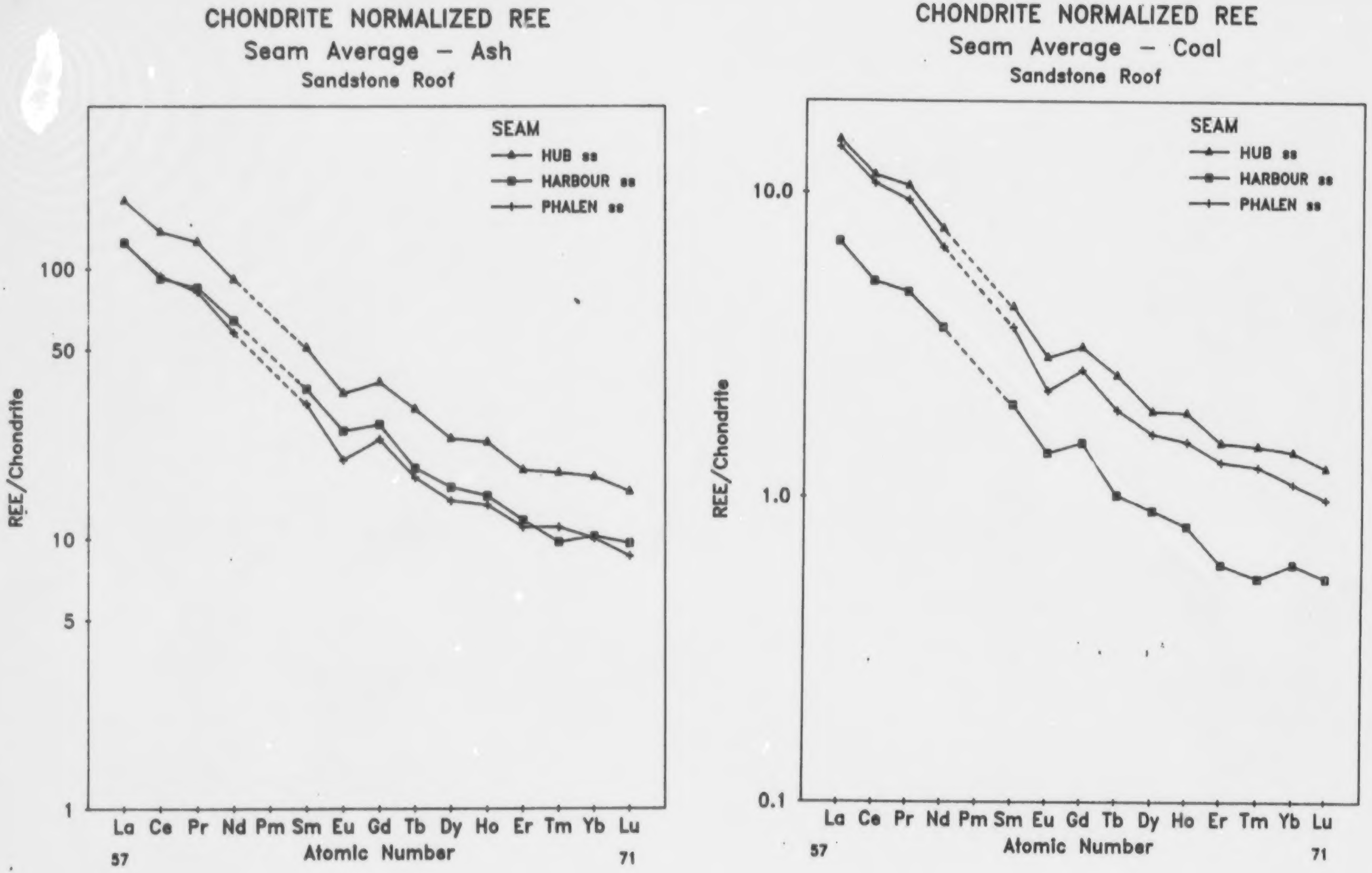
FIGURE II.43



CHONDRITE NORMALIZED REE
Seam Average – Ash
Shale Roof

CHONDRITE NORMALIZED REE
Seam Average – Coal
Shale Roof

FIGURE II.44



CHONDRITE NORMALIZED REE
Seam Average – Ash
Sandstone Roof

CHONDRITE NORMALIZED REE
Seam Average – Coal
Sandstone Roof

APPENDIX III

ANALYTICAL PROGRAMME II

A. Plastometry and Dilatometry

B. Coal Petrography
  i) Maceral/Mineral Composition
  ii) Vitrinite Reflectance

C. Scanning Electron Microscopy
  i) Summary Tables
  ii) Raw Data

NOTE: Analytical Programme II

Average compositions were calculated by volume using the following formula:

$$\text{Average } ' = \Sigma \ \frac{x * t}{T}$$

Where: x = analytical value
t = thickness of ply
T = total thickness of seam

APPENDIX III

A. Plastometry and Dilatometry

APPENDIX III A. Plastometry and Dilatometry

List of Tables

TABLE III.1	Average plastometry results of selected seams-Sydney Basin.
TABLE III.2	Plastometry results of Hub Seam, Prince Mine.
TABLE III.3	Plastometry results of Harbour Seam, Lingan Mine.
TABLE III.4	Plastometry results of Phalen Seam, Phalen Colliery.
TABLE III.5	Average dilatometry results of selected seams-Sydney Basin.
TABLE III.6	Dilatometry results of Hub Seam, Prince Mine.
TABLE III.7	Dilatometry results of Harbour Seam, Lingan Mine.
TABLE III.8	Dilatometry results of Phalen Seam, Phalen Colliery.

Table III.1 Average' plastometry results of selected seams - Sydney Basin.

SEAM/ MINE	ROOF ROCK	INITIAL SOFTENING TEMPERATURE	MAX. FLUIDITY TEMPERATURE	SOLIDIFICATION TEMPERATURE	MAXIMUM FLUIDITY (D.D.P.M.)@
Hub Seam	Shale	397	434	458	116.3
Prince Mine	Sandstone	391	433	461	797.8
Harbour Seam	Shale	394	445	484	28830
Lingan Mine	Sandstone	385	446	486	32931
Phalen Seam	Shale	371	433	475	3511.3
Phalen Colliery	Sandstone	370	430	472	9981

Table III.2 Plastometry results of Hub Seam, Prince Mine.

SAMPLE INTERVAL (m)	INITIAL SOFTENING TEMPERATURE	MAX. FLUIDITY TEMPERATURE	SOLIDIFICATION TEMPERATURE	MAXIMUM FLUIDITY (D.D.P.M.)@
Shale Roof				
0.00 - 0.08	406	436	458	69.5
0.08 - 0.23	403	440	465	424.1
0.23 - 0.38	399	437	460	282.5
0.38 - 1.28#	401	436	460	65.6
1.28 - 2.03#	393	432	456	89.0
2.03 - 2.18	388	430	454	120.7
2.18 - 2.33	394	433	458	175.2
2.33 - 2.43	393	422	441	8.0
Average'	397	434	458	116.3
Sandstone Roof				
0.00 - 0.15	387	428	461	686.3
0.15 - 0.30	391	435	462	1672.1
0.30 - 0.45	388	435	464	245.2
0.45 - 1.52#	400	439	466	598.6
clay parting 0.01m				
1.53 - 1.68	379	429	459	1281.6
1.68 - 1.83	382	427	463	1456.9
1.83 - 1.98	386	428	458	918.9
Average'	391	433	461	797.8

@ Dial Divisions per Minute

# Composite sample

' Weighted Average (excluding clay partings)

Table III.3 Plastometry results of Harbour Seam, Lingan Mine.

SAMPLE INTERVAL (m)	INITIAL SOFTENING TEMPERATURE	MAX. FLUIDITY TEMPERATURE	SOLIDIFICATION TEMPERATURE	MAXIMUM FLUIDITY (D.D.P.M.)@
Shale Roof				
0.00 - 0.15	410	463	499	31123
0.15 - 0.30	402	453	492	30635
0.30 - 0.45	382	436	481	31756
0.45 - 1.35*	394	445	481	27072
1.35 - 1.50	389	434	483	30483
1.50 - 1.65	390	435	478	27836
1.65 - 1.80	387	446	484	31696
Average'	394	445	484	28830
Sandstone Roof				
0.00 - 0.15	364	439	487	32271
0.15 - 0.30	371	445	487	32341
0.30 - 0.45	369	453	487	32853
0.45 - 1.20*	395	449	486	33358
1.20 - 1.35	383	443	484	32576
1.35 - 1.50	383	449	486	32935
1.50 - 1.65	386	433	488	32480
Average'	385	446	486	32931

@ Dial Divisions per Minute

* Composite sample

' Weighted Average (excluding clay partings)

Table III.4 Plastometry results of Phalen Seam, Phalen Colliery.

SAMPLE INTERVAL (m)	INITIAL SOFTENING TEMPERATURE	MAX. FLUIDITY TEMPERATURE	SOLIDIFICATION TEMPERATURE	MAXIMUM FLUIDITY (D.D.P.M.)@
Shale Roof				
0.00 - 0.15	399	444	487	9173.0
0.15 - 0.30	400	444	482	11595.6
0.30 - 0.45	403	446	487	8183.4
0.45 - 0.93*!	374	429	473	2006
0.93 - 2.13*!	360	431	472	1259
2.13 - 2.28	399	444	477	2095.2
2.28 - 2.48!	356	428	474	10001
clay parting (0.05m)				
2.53 - 2.73!	356	426	470	1397
Average'	371	433	475	3511.3
Sandstone Roof				
0.00 - 0.15!	341	429	471	9138
0.15 - 0.30!	384	428	469	11653
0.30 - 0.45!	355	426	472	8360
0.45 - 1.35*!	384	430	474	15736
1.35 - 1.45!	345	432	472	4082
clay parting (0.05m)				
1.50 - 1.65!	385	433	477	1692
1.65 - 1.98!	347	431	466	200
Average'	370	430	472	9981

@ Dial Divisions per Minute
* Composite sample
' Weighted Average (excluding clay partings)
! Subcontractor's results

Table III.5 Average' dilatometry results of selected seams - Sydnev Basin.

SEAM/MINE	ROOF ROCK	SOFTENING TEMPERATURE	CONTRACTION TEMPERATURE	MAX. DILATATION TEMPERATURE	PERCENT CONTRACTION	PERCENT DILATATION	G FACTOR
Hub Seam	Shale	370	413	440	32	27	0.92
Prince Mine	Sandstone	371	409	441	31	54	1.02
Harbour Seam	Shale	367	406	481	28	235	1.12
Lingan Mine	Sandstone	354	395	482	30	251	1.14
Phalen Seam	Shale	364	399	442	27	89	1.05
Phalen Colliery	Sandstone	358	393	441	29	125	1.05

Table III.6 Dilatometry results of Hub Seam, Prince Mine.

SAMPLE INTERVAL (m)	SOFTENING TEMPERATURE	CONTRACTION TEMPERATURE	MAX. DILATATION TEMPERATURE	PERCENT CONTRACTION	PERCENT DILATATION	G FACTOR
Shale Roof						
0.00 - 0.08	389	427	427	28	--	--
0.08 - 0.23	370	415	440	36	28	0.99
0.23 - 0.38	377	416	437	34	19	0.98
0.38 - 1.28*	370	417	445	33	22	0.98
1.28 - 2.03*	368	406	437	30	39	1.01
2.03 - 2.18	366	405	437	33	56	1.02
2.18 - 2.33	373	411	434	27	4	0.95
2.33 - 2.43	366	414	436	32	--	--
Average'	370	413	440	32	27	0.92
Sandstone Roof						
0.00 - 0.15	366	405	442	32	73	1.04
0.15 - 0.30	372	409	448	29	49	1.02
0.30 - 0.45	374	416	442	28	26	1.00
0.45 - 1.52*	376	411	441	31	57	1.02
clay parting (0.01m)						
1.53 - 1.68	345	400	432	35	56	1.02
1.68 - 1.83	369	404	437	31	38	1.01
1.83 - 1.98	362	402	440	27	58	1.04
Average'	371	409	441	31	54	1.02

- No Dilatation
* Composites
' Weighted Average (excluding clay partings)

Table III.7 Dilatometry results of the Harbour Seam, Lingan Mine.

SAMPLE INTERVAL (m)	SOFTENING TEMPERATURE	CONTRACTION TEMPERATURE	MAX. DILATATION TEMPERATURE	PERCENT CONTRACTION	PERCENT DILATATION	G FACTOR
Shale Roof						
0.00 - 0.15	362	405	498	29	320	1.15
0.15 - 0.30	373	404	474	28	432	1.12
0.30 - 0.45	341	403	475	29	239	1.15
0.45 - 1.35*	369	407	482	26	199	1.11
1.35 - 1.50	366	405	477	33	205	1.10
1.50 - 1.65	372	407	478	33	217	1.11
1.65 - 1.80	370	403	478	29	214	1.11
Average'	367	406	481	28	235	1.12
Sandstone Roof						
0.00 - 0.15	332	387	460	32	280	1.15
0.15 - 0.30	389	394	472	30	251	1.08
0.30 - 0.45	339	392	480	27	268	1.16
0.45 - 1.20*	346	393	484	30	256	1.15
1.20 - 1.35	362	400	496	33	252	1.14
1.35 - 1.50	360	400	496	30	227	1.14
1.50 - 1.65	379	405	475	26	203	1.10
Average'	354	395	482	30	251	1.14

* Composites

' Weighted Average (excluding clay partings)

Table III.8 Dilatometry results of Phalen Seam, Phalen Colliery.

SAMPLE INTERVAL (m)	SOFTENING TEMPERATURE	CONTRACTION TEMPERATURE	MAX. DILATATION TEMPERATURE	PERCENT CONTRACTION	PERCENT DILATATION	G FACTOR
Shale Roof						
0.00 - 0.15	369	418	462	32	130	1.07
0.15 - 0.30	373	417	462	33	98	1.06
0.30 - 0.45	377	419	464	32	119	1.06
0.45 - 0.93*	370	399	440	29	77	1.04
0.93 - 2.13*	364	399	440	25	74	1.05
2.13 - 2.28	351	386	429	28	79	1.05
2.28 - 2.48	344	375	438	27	184	1.10
clay parting (0.05m)						
2.53 - 2.73	354	386	425	24	60	1.04
Average'	364	399	442	27	89	1.05
Sandstone Roof						
0.00 - 0.15	351	386	443	28	127	1.08
0.15 - 0.30	343	391	442	30	116	1.08
0.30 - 0.45	351	389	448	29	169	1.09
0.45 - 1.35*	363	392	446	30	172	1.08
1.35 - 1.45	354	389	443	30	96	1.06
clay parting (0.05m)						
1.50 - 1.65	356	397	439	30	98	1.06
1.65 - 1.98*	358	399	426	25	1	0.93
Average'	358	393	441	29	125	1.05

- No Dilatation
* Composites
' Weighted Average (excluding clay partings)

APPENDIX III

B. Coal Petrography

i) Maceral/Mineral Composition

APPENDIX III B. Coal Petrography

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GROUP	HUB SEAM				HARBOUR SEAM				PHALEN SEAM			
MACERAL	SHALE ROOF		SANDSTONE ROOF		SHALE ROOF		SANDSTONE ROOF		SHALE ROOF		SANDSTONE ROOF	
(vol.%)	total	mm free	total	mm free	total	mm free	total	mm free	total	mm free	total	mm free
VITRINITE	73.8	77.9	73.7	78.1	75.3	76.6	70.6	72.5	76.3	78.4	68.6	73.3
LIPTINITE	8.6	9.1	8.2	8.7	9.8	10.0	8.9	9.1	7.8	7.9	8.9	9.5
SEMI-INERTINITE	6.5	6.9	5.3	5.6	6.1	6.3	7.6	7.8	5.8	5.9	6.5	7.0
INERTINITE	5.9	6.1	7.2	7.6	7.0	7.1	10.4	10.6	7.6	7.8	9.5	10.2
MINERAL MATTER	5.2	---	5.6	---	1.8	---	2.5	---	2.5	---	6.5	---
VITRINITE REFLECTANCE	0.76		0.79		0.99		0.92		0.94		0.95	

TABLE III.10 Group maceral and mineral composition of the Hub seam, Prince Mine, without sandstone channel influence in the roof.

INTERVAL (m)	VITRINITE	LIPTINITE	SEMI-INERTINITE	INERTINITE	MINERAL MATTER
0.00 - 0.08	56.0	12.8	8.6	6.6	16.0
0.08 - 0.23	62.0	15.8	11.4	10.4	0.4
0.23 - 0.38	59.2	16.2	12.4	9.0	3.2
0.38 - 1.28*	79.2	7.0	6.2	7.2	0.4
1.28 - 2.03*	76.4	8.2	7.0	3.8	4.6
2.03 - 2.18	80.2	6.4	1.6	3.2	8.6
2.18 - 2.33	69.6	11.2	4.2	4.2	10.8
2.33 - 2.43	66.2	5.6	1.8	3.8	22.6
SEAM AVERAGE'	73.8	8.6	6.5	5.9	5.2

* Composite

' Weighted seam average

TABLE III.11 Maceral and mineral composition of the Hub seam, Prince Mine, without sandstone channel influence in the roof.

HUB SEAM PRINCE MINE Shale Roof	REACTIVE (vol.%)							INERT (vol.%)											MEAN VITRINITE REFLECTANCE
	VITRINITE	LIPTINITE				SEMI-INERTINITE		SEMI-INERTINITE		INERTINITE					MINERAL MATTER				
						REACTIVE		INERT											
INTERVAL (m)	VITRINITE	SPORINITE	CUTINITE	ALGINITE	RESINITE	SEMIFUSINITE	SEMIMACRINITE	SEMIFUSINITE	SEMIMACRINITE	MACRINITE	FUSINITE	MICRINITE	SCLERO-TINITE	INERTO-DETRINITE	PYRITE	QUARTZ	CLAYS	OTHER	Ro (%)
0.00 - 0.08	56.0	10.8	0.4	1.0	0.6	2.7	0.1	5.5	0.3	0.8	2.0	3.0	0.6	0.2	11.6	0.0	4.0	0.4	0.71
0.08 - 0.23	62.0	13.0	0.0	1.8	1.0	3.4	0.4	6.8	0.8	2.4	1.8	4.4	0.8	1.0	0.0	0.0	0.4	0.0	0.75
0.23 - 0.38	59.2	14.2	0.0	1.6	0.4	3.5	0.6	7.1	1.2	1.4	2.2	3.8	0.6	1.0	2.8	0.0	0.4	0.0	0.76
0.38 - 1.28*	79.2	4.4	0.0	0.8	1.8	1.9	0.2	3.7	0.4	0.0	3.4	3.2	0.4	0.2	0.4	0.0	0.0	0.0	0.79
1.28 - 2.03*	76.4	5.8	0.0	0.6	1.8	2.3	0.1	4.5	0.1	0.2	1.4	1.4	0.4	0.4	2.2	0.2	2.2	0.0	0.77
2.03 - 2.18	80.2	5.8	0.0	0.0	0.6	0.5	0.0	1.1	0.0	0.2	1.6	0.6	0.4	0.4	7.6	0.2	0.8	0.0	0.74
2.18 - 2.33	69.6	8.4	0.2	2.0	0.6	1.2	0.2	2.4	0.4	0.6	2.2	1.2	0.2	0.0	6.2	0.0	4.6	0.0	0.73
2.33 - 2.43	66.2	5.0	0.2	0.4	0.0	0.6	0.0	1.2	0.0	0.6	2.6	0.2	0.2	0.2	17.0	0.4	5.2	0.0	0.71
SEAM AVERAGE'	73.8	6.5	0.0	0.8	1.3	2.0	0.2	4.0	0.3	0.4	2.4	2.3	0.4	0.4	3.5	0.1	1.6	0.0	0.76

* Composite

' Weighted seam average

TABLE III.12 **Recalculated composition (mineral matter free) of the Hub seam, Prince Mine, without sandstone channel influence in the roof.**

HUB SEAM PRINCE MINE Shale Roof	REACTIVE (vol.%)							INERT (vol.%)						
	VITRINITE	LIPTINITE				SEMI-INERTINITE		SEMI-INERTINITE		INERTINITE				
						REACTIVE		INERT						
INTERVAL (m)	VITRINITE	SPORINITE	CUTINITE	ALGINITE	RESINITE	SEMIFUSINITE	SEMINACRINITE	SEMIFUSINITE	SEMINACRINITE	MACRINITE	FUSINITE	MICRINITE	SCLERO-TINITE	INERTO-DETRINITE
0.00 - 0.08	66.7	12.9	0.5	1.2	0.7	3.3	0.2	6.5	0.3	1.0	2.4	3.6	0.7	0.2
0.08 - 0.23	62.2	13.1	0.0	1.8	1.0	3.4	0.4	6.8	0.8	2.4	1.8	4.4	0.8	1.0
0.23 - 0.38	61.2	14.7	0.0	1.7	0.4	3.7	0.6	7.3	1.2	1.4	2.3	3.9	0.6	1.0
0.38 - 1.28*	79.5	4.4	0.0	0.8	1.8	1.9	0.2	3.7	0.4	0.0	3.4	3.2	0.4	0.2
1.28 - 2.03*	80.0	6.1	0.0	0.6	1.9	2.4	0.1	4.8	0.1	0.2	1.5	1.5	0.4	0.4
2.03 - 2.18	87.7	6.3	0.0	0.0	0.7	0.6	0.0	1.2	0.0	0.2	1.8	0.7	0.4	0.4
2.18 - 2.33	78.0	9.4	0.2	2.2	0.7	1.3	0.2	2.7	0.4	0.7	2.5	1.3	0.2	0.0
2.33 - 2.43	85.5	6.5	0.3	0.5	0.0	0.8	0.0	1.6	0.0	0.8	3.4	0.3	0.3	0.3
SEAM AVERAGE'	77.9	6.8	0.0	0.9	1.4	2.1	0.2	4.2	0.4	0.4	2.5	2.4	0.4	0.4

* Composite

' Weighted seam average

TABLE III.13 Group maceral and mineral composition of the Hub seam, Prince Mine, with sandstone channel influence in the roof.

INTERVAL (m)	VITRINITE	LIPTINITE	SEMI-INERTINIT	INERTINIT	MINERAL MATTER
0.00 - 0.15	65.8	9.0	9.2	7.8	8.2
0.15 - 0.30	60.2	12.2	10.8	12.0	4.8
0.30 - 0.45	59.6	13.0	13.0	12.2	2.2
0.45 - 1.52*	76.8	6.8	4.2	6.8	5.4
1.52 - 1.53	clay parting				
1.53 - 1.68	77.4	8.2	2.4	5.0	7.0
1.68 - 1.83	79.0	5.8	1.8	5.2	8.2
1.83 - 1.98	77.8	10.4	2.6	4.4	4.8
SEAM AVERAGE′	73.7	8.2	5.3	7.2	5.6

* Composite
′ Weighted seam average

Table III.14 Maceral and mineral composition of the Hub seam, Prince Mine, with sandstone channel influence in the roof.

HUB SEAM PRINCE MINE Sandstone Roof	REACTIVE (vol.%)							INERT (vol.%)											MEAN VITRINITE REFLECTANCE
	VITRINITE	LIPTINITE				SEMI-INERTINITE		SEMI-INERTINITE		INERTINITE					MINERAL MATTER				
INTERVAL (m)	VITRINITE	SPORINITE	CUTINITE	ALGINITE	RESINITE	REACTIVE SEMIFUSINITE	SEMIMACRINITE	INERT SEMIFUSINITE	SEMIMACRINITE	MACRINITE	FUSINITE	MICRINITE	SCLERO-TINITE	INERTO-DETRINITE	PYRITE	QUARTZ	CLAYS	OTHER	Ro (%)
0.00 - 0.15	65.8	7.0	0.4	0.6	1.0	2.5	0.5	5.1	1.1	1.0	2.8	2.4	0.8	0.8	7.6	0.0	0.6	0.0	0.74
0.15 - 0.30	60.2	9.8	0.0	1.2	1.2	3.3	0.3	6.5	0.7	1.2	4.8	4.6	1.0	0.4	3.6	0.0	1.2	0.0	0.75
0.30 - 0.45	59.6	11.2	0.2	1.0	0.6	4.0	0.3	8.0	0.7	1.8	5.0	3.8	1.2	0.4	2.0	0.0	0.2	0.0	0.81
0.45 - 1.52*	76.8	5.4	0.0	0.8	0.6	1.4	0.0	2.8	0.0	0.2	4.2	1.4	1.0	0.0	4.6	0.0	0.8	0.0	0.80
Parting 0.01																			
1.53 - 1.68	77.4	7.0	0.0	0.4	0.8	0.7	0.1	1.5	0.1	0.4	2.2	2.2	0.0	0.2	6.6	0.0	0.4	0.0	0.80
1.68 - 1.83	79.0	5.0	0.0	0.4	0.4	0.6	0.0	1.2	0.0	0.2	3.0	1.4	0.2	0.4	7.0	0.2	0.8	0.2	0.80
1.83 - 1.98	77.8	8.8	0.2	0.8	0.6	0.9	0.0	1.7	0.0	0.4	3.0	0.8	0.2	0.0	2.8	0.0	2.0	0.0	0.79
SEAM AVERAGE'	73.7	6.6	0.1	0.8	0.7	1.7	0.1	3.3	0.2	0.5	3.9	1.9	0.8	0.2	4.8	0.0	0.8	0.0	0.79

* Composite

' Weighted seam average

TABLE III.15 Recalculated composition (mineral matter free) of the Hub seam, Prince Mine, with sandstone channel influence in the roof.

HUB SEAM PRINCE MINE Sandstone Roof	REACTIVE (vol.%)							INERT (vol.%)						
	VITRINITE	LIPTINITE				SEMI-INERTINITE		SEMI-INERTINITE		INERTINITE				
						REACTIVE		INERT						
INTERVAL (m)	VITRINITE	SPORINITE	CUTINITE	ALGINITE	RESINITE	SEMIFUSINITE	SEMIMACRINITE	SEMIFUSINITE	SEMIMACRINITE	MACRINITE	FUSINITE	MICRINITE	SCLERO-TINITE	INERTO-DETRINITE
0.00 - 0.15	71.7	7.6	0.4	0.7	1.1	2.8	0.6	5.5	1.2	1.1	3.1	2.6	0.9	0.9
0.15 - 0.30	63.2	10.3	0.0	1.3	1.3	3.4	0.4	6.9	0.7	1.3	5.0	4.8	1.1	0.4
0.30 - 0.45	60.9	11.5	0.2	1.0	0.6	4.1	0.3	8.2	0.7	1.8	5.1	3.9	1.2	0.4
0.45 - 1.52*	81.2	5.7	0.0	0.8	0.6	1.5	0.0	3.0	0.0	0.2	4.4	1.5	1.1	0.0
Parting 0.01														
1.53 - 1.68	83.2	7.5	0.0	0.4	0.9	0.8	0.1	1.6	0.1	0.4	2.4	2.4	0.0	0.2
1.68 - 1.83	86.1	5.4	0.0	0.4	0.4	0.7	0.0	1.3	0.0	0.2	3.3	1.5	0.2	0.4
1.83 - 1.98	81.7	9.2	0.2	0.8	0.6	0.9	0.0	1.8	0.0	0.4	3.2	0.8	0.2	0.0
SEAM AVERAGE'	78.0	7.0	0.1	0.8	0.7	1.8	0.1	3.5	0.2	0.5	4.1	2.0	0.8	0.2

* Composite

' Weighted seam average

TABLE III.16 Group maceral and mineral composition of the Harbour seam, Lingan Mine, without sandstone channel influence in the roof.

INTERVAL (m)	VITRINITE	LIPTINITE	SEMI-INERTINITE	INERTINITE	MINERAL MATTER
0.00 - 0.15	54.2	13.8	13.6	12.6	5.8
0.15 - 0.30	68.2	8.8	9.6	11.0	2.4
0.30 - 0.45	61.8	10.6	12.6	13.8	1.2
0.45 - 1.35*	76.8	10.2	5.8	6.0	1.2
1.35 - 1.50	87.8	7.2	0.0	5.0	0.0
1.50 - 1.65	85.4	6.6	1.6	2.6	3.8
1.65 - 1.80	84.0	10.4	1.8	2.8	1.0
SEAM AVERAGE′	75.3	9.8	6.1	7.0	1.8

* Composite

′ Weighted seam average

TABLE III.17 Maceral and mineral composition of the Harbour seam, Lingan Mine, without sandstone channel influence in the roof.

HARBOUR SEAM LINGAN MINE	REACTIVE (vol.%)							INERT (vol.%)											MEAN VITRINITE REFLECTANCE
Shale Roof	VITRINITE	LIPTINITE				SEMI-INERTINITE		SEMI-INERTINITE		INERTINITE					MINERAL MATTER				
						REACTIVE		INERT											
INTERVAL (m)	VITRINITE	SPORINITE	CUTINITE	ALGINITE	RESINITE	SEMIFUSINITE	SEMIMACRINITE	SEMIFUSINITE	SEMIMACRINITE	MACRINITE	FUSINITE	MICRINITE	SCLERO-TINITE	INERTO-DETRINITE	PYRITE	QUARTZ	CLAYS	OTHER	Ro (%)
0.00 - 0.15	54.2	12.0	0.2	0.4	1.2	4.3	0.3	8.5	0.5	2.2	3.6	4.4	0.6	1.8	4.0	0.0	1.8	0.0	0.97
0.15 - 0.30	68.2	5.8	0.4	1.6	1.0	3.1	0.1	6.1	0.3	1.8	2.6	5.0	0.8	0.8	2.2	0.0	0.2	0.0	0.94
0.30 - 0.45	61.8	6.8	0.4	3.0	0.4	3.8	0.4	7.6	0.8	3.0	4.0	5.0	0.6	1.2	1.2	0.0	0.0	0.0	0.93
0.45 - 1.35•	76.8	7.0	1.0	1.4	0.8	1.8	0.1	3.6	0.3	0.8	2.4	1.6	0.4	0.8	0.6	0.0	0.4	0.2	1.00
1.35 - 1.50	87.8	5.0	0.8	0.4	1.0	0.0	0.0	0.0	0.0	0.2	2.4	1.6	0.6	0.2	0.0	0.0	0.0	0.0	1.05
1.50 - 1.65	85.4	4.8	0.8	0.6	0.4	0.5	0.1	0.9	0.1	0.6	1.4	0.0	0.2	0.4	3.4	0.0	0.0	0.4	1.03
1.65 - 1.80	84.0	8.0	0.2	1.2	1.0	0.6	0.0	1.2	0.0	0.0	1.6	1.2	0.0	0.0	0.8	0.0	0.2	0.0	1.00
SEAM AVERAGE'	75.3	7.0	0.7	1.3	0.8	1.9	0.1	3.8	0.3	1.1	2.5	2.2	0.4	0.8	1.3	0.0	0.4	0.1	0.99

• Composite

' Weighted seam average

table III.18 Recalculated composition (mineral matter free) of the Harbour seam, Lingan Mine, without sandstone channel influence in the roof.

HARBOUR SEAM	REACTIVE (vol.%)							INERT (vol.%)						
LINGAN MINE Shale Roof	VITRINITE	LIPTINITE				SEMI-INERTINITE REACTIVE		SEMI-INERTINITE INERT		INERTINITE				
INTERVAL (m)	VITRINITE	SPORINITE	CUTINITE	ALGINITE	RESINITE	SEMIFUSINITE	SEMIMACRINITE	SEMIFUSINITE	SEMIMACRINITE	MACRINITE	FUSINITE	MICRINITE	SCLERO-TINITE	INERTO-DETRINITE
0.00 - 0.15	57.5	12.7	0.2	0.4	1.3	4.5	0.3	9.1	0.6	2.3	3.8	4.7	0.6	1.9
0.15 - 0.30	69.9	5.9	0.4	1.6	1.0	3.1	0.1	6.3	0.3	1.8	2.7	5.1	0.8	0.8
0.30 - 0.45	62.6	6.9	0.4	3.0	0.4	3.8	0.4	7.7	0.8	3.0	4.0	5.1	0.6	1.2
0.45 - 1.35*	77.7	7.1	1.0	1.4	0.8	1.8	0.1	3.6	0.3	0.8	2.4	1.6	0.4	0.8
1.35 - 1.50	87.8	5.0	0.8	0.4	1.0	0.0	0.0	0.0	0.0	0.2	2.4	1.6	0.6	0.2
1.50 - 1.65	88.8	5.0	0.8	0.6	0.4	0.5	0.1	1.0	0.1	0.6	1.5	0.0	0.2	0.4
1.65 - 1.80	84.8	8.1	0.2	1.2	1.0	0.6	0.0	1.2	0.0	0.0	1.6	1.2	0.0	0.0
SEAM AVERAGE'	76.6	7.2	0.7	1.3	0.8	2.0	0.1	3.9	0.3	1.1	2.5	2.3	0.4	0.8

* Composite

' Weighted seam average

TABLE III.19 Group maceral and mineral composition of the Harbour seam, Lingan Mine, with sandstone channel influence in the roof.

INTERVAL (m)	VITRINITE	LIPTINITE	SEMI-INERTINITE	INERTINITE	MINERAL MATTER
0.00 - 0.15	71.6	8.0	8.2	8.2	4.0
0.15 - 0.30	57.0	11.0	16.8	12.4	2.8
0.30 - 0.45	56.8	11.2	17.6	10.8	3.6
0.45 - 1.20*	70.0	8.4	6.6	13.6	1.4
1.20 - 1.35	79.0	10.6	4.0	4.4	2.0
1.35 - 1.50	85.8	6.0	2.4	4.6	1.2
1.50 - 1.65	77.4	9.2	1.6	5.4	6.4
SEAM AVERAGE'	70.6	8.9	7.6	10.4	2.5

* Composite

' Weighted seam average

TABLE III.20 Maceral and mineral composition of the Harbour seam, Lingan Mine, with sandstone channel influence in the roof.

HARBOUR SEAM LINGAN MINE Sandstone Roof	REACTIVE (vol.%)							INERT (vol.%)											MEAN VITRINITE REFLECTANCE
	VITRINITE	LIPTINITE				SEMI-INERTINITE		SEMI-INERTINITE		INERTINITE					MINERAL MATTER				
						REACTIVE		INERT											
INTERVAL (m)	VITRINITE	SPORINITE	CUTINITE	ALGINITE	RESINITE	SEMIFUSINITE	SEMIMACRINITE	SEMIFUSINITE	SEMIMACRINITE	MACRINITE	FUSINITE	MICRINITE	SCLERO-TINITE	INERTO-DETRINITE	PYRITE	QUARTZ	CLAYS	OTHER	Ro (%)
0.00 - 0.15	71.6	5.6	0.4	0.0	2.0	2.1	0.6	4.3	1.2	1.2	1.6	4.4	0.4	0.6	2.2	0.2	1.6	0.0	0.81
0.15 - 0.30	57.0	7.8	0.8	1.8	0.6	4.9	0.7	9.9	1.3	3.0	1.8	5.6	0.4	1.6	2.4	0.2	0.2	0.0	0.81
0.30 - 0.45	56.8	8.6	1.4	0.8	0.4	4.9	0.9	9.9	1.9	1.0	2.0	4.4	2.2	1.2	3.2	0.0	0.4	0.0	0.79
0.45 - 1.20*	70.0	5.4	0.6	0.0	2.4	1.9	0.3	3.7	0.7	1.0	7.6	4.2	0.4	0.4	1.0	0.0	0.4	0.0	0.94
1.20 - 1.35	79.0	6.0	0.8	1.4	2.4	1.2	0.1	2.4	0.3	0.0	2.0	1.4	0.2	0.8	2.0	0.0	0.0	0.0	0.99
1.35 - 1.50	85.8	4.2	0.6	0.4	0.8	0.5	0.3	0.9	0.7	0.4	2.2	1.4	0.0	0.6	1.2	0.0	0.0	0.0	1.02
1.50 - 1.65	77.4	6.0	0.6	1.2	1.4	0.5	0.0	1.1	0.0	0.2	2.0	2.4	0.4	0.4	2.6	0.6	3.2	0.0	1.03
SEAM AVERAGE'	70.6	5.9	0.7	0.5	1.8	2.1	0.4	4.3	0.8	1.0	4.5	3.7	0.5	0.7	1.7	0.1	0.7	0.0	0.92

* Composite

' Weighted seam average

TABLE III.21 Recalculated composition (mineral matter free) of the Harbour seam, Lingan Mine, with sandstone channel influence in the roof.

HARBOUR SEAM LINGAN MINE Sandstone Roof	REACTIVE(vol.%)							INERT(vol.%)						
	VITRINITE	LIPTINITE				SEMI-INERTINITE		SEMI-INERTINITE		INERTINITE				
						REACTIVE		INERT						
INTERVAL (m)	VITRINITE	SPORINITE	CUTINITE	ALGINITE	RESINITE	SEMIFUSINITE	SEMIMACRINITE	SEMIFUSINITE	SEMIMACRINITE	MACRINITE	FUSINITE	MICRINITE	SCLERO-TINITE	INERTO-DETRINITE
0.00 - 0.15	74.6	5.8	0.4	0.0	2.1	2.2	0.6	4.4	1.3	1.3	1.7	4.6	0.4	0.6
0.15 - 0.30	58.6	8.0	0.8	1.9	0.6	5.1	0.7	10.2	1.4	3.1	1.9	5.8	0.4	1.6
0.30 - 0.45	58.9	8.9	1.5	0.8	0.4	5.1	1.0	10.2	1.9	1.0	2.1	4.6	2.3	1.2
0.45 - 1.20*	71.0	5.5	0.6	0.0	2.4	1.9	0.3	3.8	0.7	1.0	7.7	4.3	0.4	0.4
1.20 - 1.35	80.6	6.1	0.8	1.4	2.4	1.2	0.1	2.4	0.3	0.0	2.0	1.4	0.2	0.8
1.35 - 1.50	86.8	4.3	0.6	0.4	0.8	0.5	0.3	0.9	0.7	0.4	2.2	1.4	0.0	0.6
1.50 - 1.65	82.7	6.4	0.6	1.3	1.5	0.6	0.0	1.1	0.0	0.2	2.1	2.6	0.4	0.4
SEAM AVERAGE'	72.5	6.1	0.7	0.5	1.8	2.2	0.4	4.4	0.8	1.0	4.6	3.8	0.5	0.7

* Composite

' Weighted seam average

TABLE III.22 Group maceral and mineral composition of the Phalen seam, Phalen Colliery, without sandstone channel influence in the roof.

INTERVAL (m)	VITRINITE	LIPTINITE	SEMI-INERTINITE	INERTINITE	MINERAL MATTER
0.00 - 0.15	73.2	8.2	7.8	8.8	2.0
0.015 - 0.30	78.6	10.2	3.4	6.4	1.4
0.30 - 0.45	76.8	9.2	2.6	8.2	3.2
0.45 - 0.93*	75.8	8.8	5.8	4.6	5.0
0.93 - 2.13*	79.2	6.4	3.8	9.2	1.4
2.13 - 2.28	61.4	7.2	17.0	13.2	1.2
2.28 - 2.48	77.8	7.6	7.2	5.4	2.0
2.48 - 2.53					
2.53 - 2.73	70.4	9.0	10.2	3.8	6.6
SEAM AVERAGE'	76.3	7.8	5.8	7.6	2.5

* Composite

' Weighted seam average (excluding parting)

TABLE III.23 Maceral and mineral composition of the Phalen seam, Phalen Colliery, without sandstone channel influence in the roof.

PHALEN SEAM PHALEN COLLIERY Shale Roof	REACTIVE(vol.%)							INERT(vol.%)											MEAN VITRINITE REFLECTANCE
	VITRINITE	LIPTINITE				SEMI-INERTINITE		SEMI-INERTINITE		INERTINITE					MINERAL MATTER				
						REACTIVE		INERT											
INTERVAL (m)	VITRINITE	SPORINITE	CUTINITE	ALGINITE	RESINITE	SEMIFUSINITE	SEMIMACRINITE	SEMIFUSINITE	SEMIMACRINITE	MACRINITE	FUSINITE	MICRINITE	SCLERO-TINITE	INERTO-DETRINITE	PYRITE	QUARTZ	CLAYS	OTHER	Ro (%)
0.00 - 0.15	73.2	4.6	0.6	0.4	2.6	2.5	0.1	4.9	0.3	0.4	6.4	1.0	0.2	0.8	1.8	0.0	0.0	0.2	0.89
0.15 - 0.30	78.6	6.2	0.0	1.6	2.4	1.1	0.1	2.1	0.1	1.0	2.8	1.8	0.4	0.4	0.6	0.0	0.8	0.0	0.92
0.30 - 0.45	76.8	5.2	0.8	1.4	1.8	0.8	0.1	1.6	0.1	0.2	4.6	2.2	0.4	0.8	0.2	0.0	1.6	1.4	0.96
0.45 - 0.93*	75.8	6.4	0.4	1.6	0.4	1.7	0.2	3.5	0.4	1.6	2.6	0.4	0.0	0.0	0.6	0.0	4.4	0.0	0.93
0.93 - 2.13*	79.2	4.8	0.2	1.0	0.4	1.1	0.1	2.3	0.3	0.6	6.6	1.2	0.6	0.2	0.6	0.0	0.8	0.0	0.96
2.13 - 2.28	61.4	3.8	0.0	0.6	2.8	5.3	0.4	10.5	0.8	0.6	10.2	2.0	0.4	0.0	1.2	0.0	0.0	0.0	0.91
2.28 - 2.48	77.8	4.8	0.2	1.6	1.0	2.2	0.2	4.4	0.4	0.4	3.2	1.2	0.4	0.2	1.2	0.0	0.4	0.4	0.91
2.48 - 2.53	clay parting																		
2.53 - 2.73	70.4	5.2	0.0	1.2	2.6	3.2	0.2	6.4	0.4	0.2	1.2	1.4	0.8	0.2	6.2	0.0	0.0	0.4	0.91
SEAM AVERAGE'	76.3	5.2	0.3	1.2	1.1	1.8	0.2	3.5	0.3	0.7	5.1	1.2	0.4	0.2	1.1	0.0	1.3	0.1	0.94

* Composite

' Weighted seam average (excluding parting)

TABLE III.24 Recalculated composition (mineral matter free) of the Phalen seam, Phalen Colliery, without sandstone channel influence in the roof.

PHALEN SEAM PHALEN COLLIERY Shale Roof	REACTIVE(vol.%)							INERT(vol.%)						
	VITRINITE	LIPTINITE				SEMI-INERTINITE		SEMI-INERTINITE		INERTINITE				
						REACTIVE		INERT						
INTERVAL (m)	VITRINITE	SPORINITE	CUTINITE	ALGINITE	RESINITE	SEMIFUSINITE	SEMIMACRINITE	SEMIFUSINITE	SEMIMACRINITE	MACRINITE	FUSINITE	MICRINITE	SCLERO-TINITE	INERTO-DETRINITE
0.00 - 0.15	74.7	4.7	0.6	0.4	2.7	2.5	0.1	5.0	0.3	0.4	6.5	1.0	0.2	0.8
0.15 - 0.30	79.7	6.3	0.0	1.6	2.4	1.1	0.1	2.2	0.1	1.0	2.8	1.8	0.4	0.4
0.30 - 0.45	79.3	5.4	0.8	1.4	1.9	0.8	0.1	1.7	0.1	0.2	4.8	2.3	0.4	0.8
0.45 - 0.93*	79.8	6.7	0.4	1.7	0.4	1.8	0.2	3.6	0.4	1.7	2.7	0.4	0.0	0.0
0.93 - 2.13*	80.3	4.9	0.2	1.0	0.4	1.1	0.1	2.3	0.3	0.6	6.7	1.2	0.6	0.2
2.13 - 2.28	62.1	3.8	0.0	0.6	2.8	5.3	0.4	10.7	0.8	0.6	10.3	2.0	0.4	0.0
2.28 - 2.48	79.4	4.9	0.2	1.6	1.0	2.2	0.2	4.5	0.4	0.4	3.3	1.2	0.4	0.2
2.48 - 2.53	clay parting													
2.53 - 2.73	75.4	5.6	0.0	1.3	2.8	3.4	0.2	6.9	0.4	0.2	1.3	1.5	0.9	0.2
SEAM AVERAGE'	78.4	5.3	0.3	1.2	1.1	1.8	0.2	3.6	0.3	0.8	5.2	1.2	0.4	0.2

* Composite

' Weighted seam average (excluding parting)

TABLE III.25 Group maceral and mineral composition of the Phalen seam, Phalen Colliery, with sandstone channel influence in the roof.

INTERVAL (m)	VITRINITE	LIPTINITE	SEMI-INERTINITE	INERTINITE	MINERAL MATTER
0.00 - 0.15	55.8	14.4	10.4	13.0	6.4
0.15 - 0.30	62.6	10.6	11.2	11.0	4.6
0.30 - 0.45	77.6	8.8	3.4	7.8	2.4
0.45 - 1.35*	72.2	8.8	5.2	10.6	3.2
1.35 - 1.45	73.8	9.0	4.8	8.6	3.8
1.45 - 1.50					
1.50 - 1.65	73.2	8.6	5.6	7.6	5.0
1.65 - 1.98*	59.4	6.0	8.4	6.6	19.6
SEAM AVERAGE'	68.6	8.9	6.5	9.5	6.5

* Composite

' Weighted seam average (excluding parting)

TABLE III.26 Maceral and mineral composition of the Phalen seam, Phalen Colliery, with sandstone channel influence in the roof.

PHALEN SEAM	REACTIVE (vol.%)							INERT (vol.%)											MEAN VITRINITE REFLECTANCE
PHALEN COLLIERY Sandstone Roof	VITRINITE	LIPTINITE				SEMI-INERTINITE		SEMI-INERTINITE		INERTINITE					MINERAL MATTER				
						REACTIVE		INERT											
INTERVAL (m)	VITRINITE	SPORINITE	CUTINITE	ALGINITE	RESINITE	SEMIFUSINITE	SEMIMACRINITE	SEMIFUSINITE	SEMIMACRINITE	MACRINITE	FUSINITE	MICRINITE	SCLERO-TINITE	INERTO-DETRINITE	PYRITE	QUARTZ	CLAYS	OTHER	Ro (%)
0.00 - 0.15	55.8	8.4	0.2	2.8	3.0	3.0	0.5	6.0	0.9	0.8	5.8	5.4	0.8	0.2	3.2	0.0	3.2	0.0	0.88
0.15 - 0.30	62.6	9.0	0.0	1.2	0.4	3.1	0.7	6.1	1.3	1.4	4.6	2.8	1.2	1.0	4.2	0.0	0.4	0.0	0.95
0.30 - 0.45	77.6	6.6	0.2	0.4	1.6	1.1	0.0	2.3	0.0	0.6	3.0	3.6	0.0	0.6	2.2	0.0	0.0	0.2	0.96
0.45 - 1.35*	72.2	5.8	0.0	0.6	2.4	1.6	0.1	3.2	0.3	0.4	5.2	4.2	0.2	0.6	2.8	0.0	0.4	0.0	0.96
1.35 - 1.45	73.8	6.0	0.4	1.6	1.0	1.4	0.2	2.8	0.4	0.2	4.0	4.2	0.0	0.2	2.6	0.0	1.2	0.0	0.95
1.45 - 1.50	clay parting																		
1.50 - 1.65	73.2	5.6	0.0	1.2	1.8	1.7	0.1	3.5	0.3	0.2	3.8	2.8	0.4	0.4	3.4	0.0	1.4	0.2	0.96
1.65 - 1.98*	59.4	3.4	0.0	1.2	1.4	2.7	0.1	5.3	0.3	0.6	2.0	3.4	0.4	0.2	4.8	1.4	13.2	0.2	0.95
SEAM AVERAGE'	68.6	5.9	0.1	1.0	1.9	2.0	0.2	3.9	0.4	0.5	4.3	3.9	0.3	0.5	3.3	0.2	2.9	0.1	0.95

* Composite

' Weighted seam average (excluding parting)

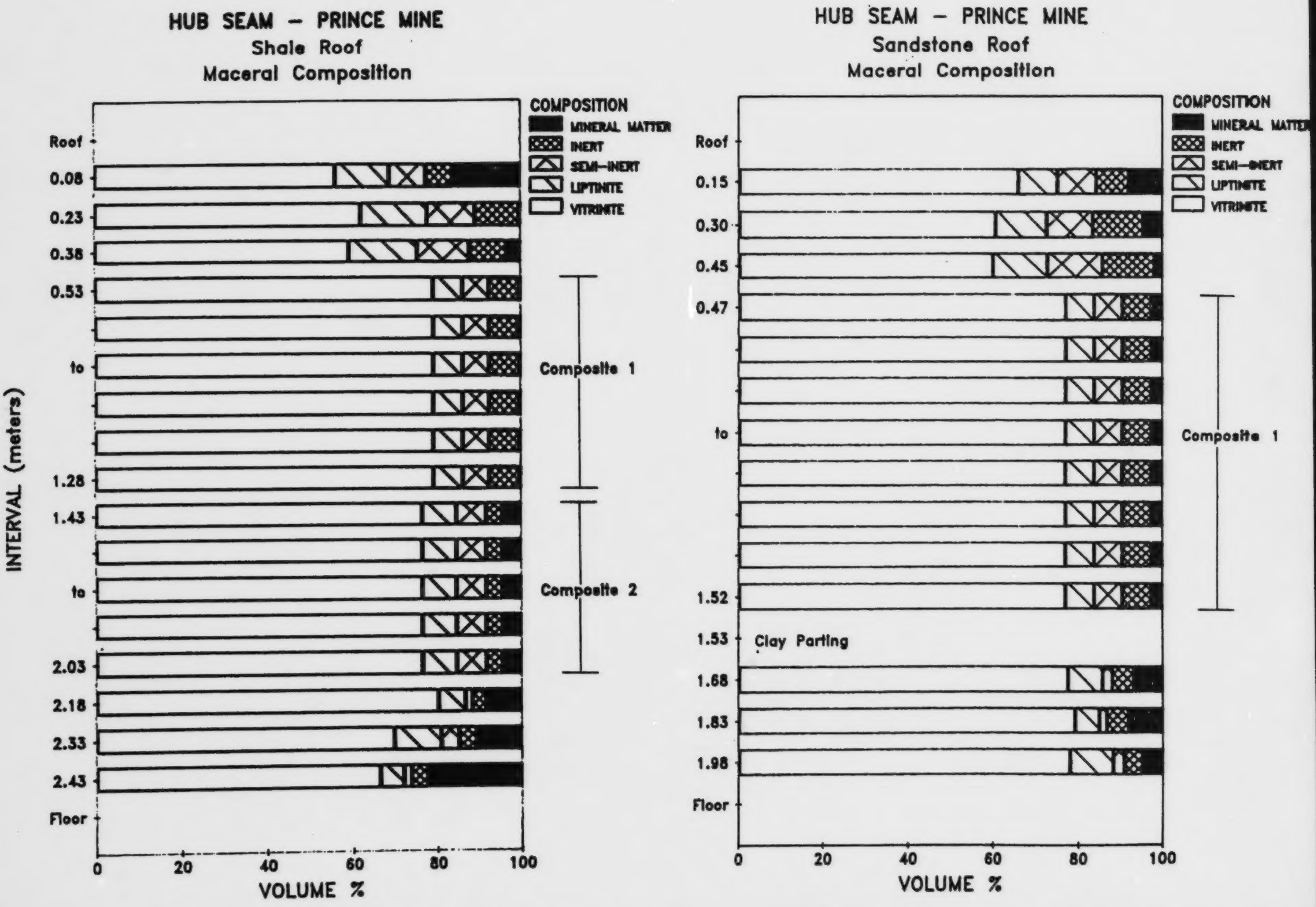
TABLE III.27 Recalculated composition (mineral matter free) of the Phalen seam, Phalen Colliery, with sandstone channel influence in the roof.

PHALEN SEAM PHALEN COLLIERY	REACTIVE(vol.%)							INERT(vol.%)						
Sandstone Roof	VITRINITE	LIPTINITE				SEMI-INERTINITE		SEMI-INERTINITE		INERTINITE				
						REACTIVE		INERT						
INTERVAL (m)	VITRINITE	SPORINITE	CUTINITE	ALGINITE	RESINITE	SEMIFUSINITE	SEMIMACRINITE	SEMIFUSINITE	SEMIMACRINITE	MACRINITE	FUSINITE	MICRINITE	SCLERO-TINITE	INERTO-DETRINITE
0.00 - 0.15	59.6	9.0	0.2	3.0	3.2	3.2	0.5	6.4	1.0	0.9	6.2	5.8	0.9	0.2
0.15 - 0.30	65.6	9.4	0.0	1.3	0.4	3.2	0.7	6.4	1.4	1.5	4.8	2.9	1.3	1.0
0.30 - 0.45	79.5	6.8	0.2	0.4	1.6	1.2	0.0	2.3	0.0	0.6	3.1	3.7	0.0	0.6
0.45 - 1.35*	74.6	6.0	0.0	0.6	2.5	1.7	0.1	3.3	0.3	0.4	5.4	4.3	0.2	0.6
1.35 - 1.45	76.7	6.2	0.4	1.7	1.0	1.5	0.2	2.9	0.4	0.2	4.2	4.4	0.0	0.2
1.45 - 1.50	clay parting													
1.50 - 1.65	77.1	5.9	0.0	1.3	1.9	1.8	0.1	3.6	0.3	0.2	4.0	2.9	0.4	0.4
1.65 - 1.98*	73.9	4.2	0.0	1.5	1.7	3.3	0.2	6.6	0.3	0.7	2.5	4.2	0.5	0.2
SEAM AVERAGE'	73.3	6.2	0.1	1.1	2.1	2.1	0.2	4.3	0.4	0.6	4.5	4.2	0.4	0.5

* Composite

' Weighted seam average (excluding parting)

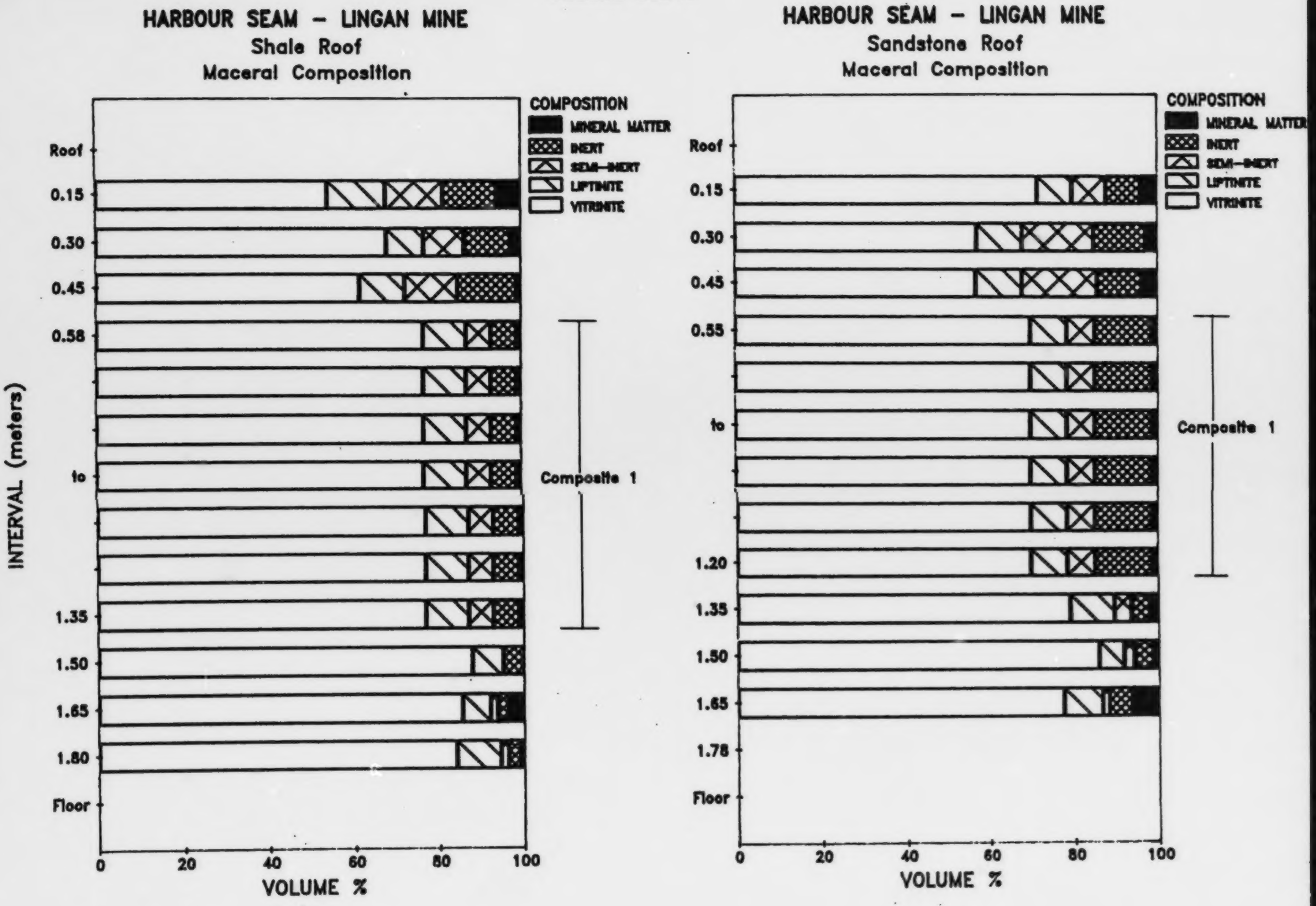
FIGURE III.1



HUB SEAM - PRINCE MINE
Shale Roof
Maceral Composition

HUB SEAM - PRINCE MINE
Sandstone Roof
Maceral Composition

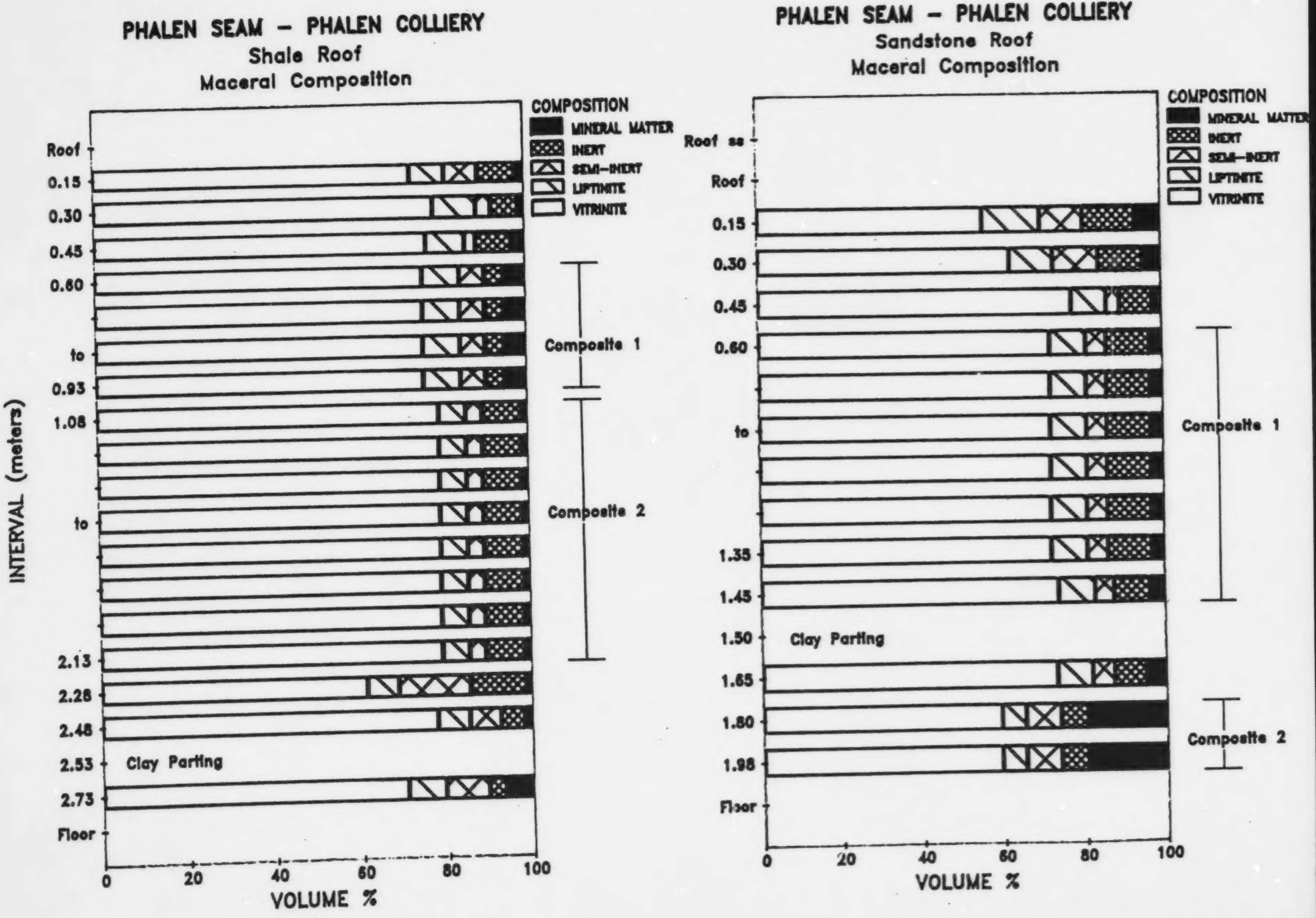
FIGURE III.2



HARBOUR SEAM – LINGAN MINE
Shale Roof
Maceral Composition

HARBOUR SEAM – LINGAN MINE
Sandstone Roof
Maceral Composition

FIGURE III.3



PHALEN SEAM - PHALEN COLLIERY
Shale Roof
Maceral Composition

PHALEN SEAM - PHALEN COLLIERY
Sandstone Roof
Maceral Composition

TABLE III.28 Coke stability calculations for the Hub Seam, Prince Mine.

INTERVAL (m)	% TOTAL REACTIVES	% TOTAL INERTS	PARR'S MIN.MAT.	OPTIMUM INERT	OPTIMUM STRENGTH	BALANCE INDEX	STRENGTH INDEX	COKE STABILITY	
Shale Roof									
0.00 - 0.08	69.44	30.56	18.61	21.73	170.48	1.41	2.46	9	
0.08 - 0.23	80.12	19.88	2.20	26.06	225.94	0.76	2.82	29	
0.23 - 0.38	80.49	19.51	2.04	26.24	227.22	0.74	2.82	28	
0.38 - 1.28*	86.95	13.05	1.89	29.25	239.98	0.45	2.76	18	
1.28 - 2.03*	87.73	12.27	3.73	28.96	239.62	0.42	2.73	15	
2.03 - 2.18	87.85	12.15	7.84	28.01	236.11	0.43	2.69	14	
2.18 - 2.33	82.98	17.02	9.95	26.40	230.22	0.64	2.77	25	
2.33 - 2.43	78.68	21.32	15.88	24.74	217.88	0.86	2.77	28	
Average'	85.26	14.74	4.48	28.09	234.18	0.54	2.74	19	(21)
Sandstone Roof									
0.00 - 0.15	75.93	24.07	10.48	24.21	210.25	0.99	2.77	29	
0.15 - 0.30	75.63	24.37	5.27	24.55	210.11	0.99	2.78	29	
0.30 - 0.45	75.55	24.45	3.95	26.29	221.15	0.93	2.93	33	
0.45 - 1.52*	86.74	13.26	3.47	29.69	242.42	0.45	2.79	19	
1.52 - 1.53									
1.53 - 1.68	85.99	14.01	7.44	29.29	240.11	0.48	2.78	21	
1.68 - 1.83	85.25	14.75	8.36	28.80	238.19	0.51	2.79	22	
1.83 - 1.98	85.44	14.56	8.68	29.04	239.23	0.50	2.80	22	
Average'	83.95	16.05	5.25	28.47	235.15	0.58	2.80	22	(24)

* Composite

' Weighted seam average

() Coke Stability based on seam averages of Balance and Strength Indices.

TABLE III.29 Coke stability calculations for the Harbour Seam, Lingan Mine.

INTERVAL (m)	% TOTAL REACTIVES	% TOTAL INERTS	PARR'S MIN.MAT.	OPTIMUM INERT	OPTIMUM STRENGTH	BALANCE INDEX	STRENGTH INDEX	COKE STABILITY	
Shale Roof									
0.00 - 0.15	71.38	28.62	7.29	25.84	218.15	1.11	3.06	35	
0.15 - 0.30	79.75	20.25	2.94	30.66	280.31	0.66	3.51	44	
0.30 - 0.45	75.55	24.45	2.55	28.94	265.60	0.84	3.52	46	
0.45 - 1.35*	88.21	11.79	2.00	35.51	303.94	0.33	3.45	34	
1.35 - 1.50	94.36	5.64	0.67	38.82	321.67	0.15	3.41	12	
1.50 - 1.65	93.68	6.32	2.61	38.64	314.63	0.16	3.36	12	
1.65 - 1.80	92.88	7.12	3.21	37.39	303.31	0.19	3.27	15	
Average'	86.41	13.59	2.61	34.45	293.94	0.42	3.40	31	(35)
Sandstone Roof									
0.00 - 0.15	80.68	19.32	5.93	27.98	234.05	0.69	2.90	30	
0.15 - 0.30	72.83	27.57	3.82	25.05	207.35	1.08	2.85	30	
0.30 - 0.45	73.31	26.69	4.33	24.86	206.73	1.07	2.82	30	
0.45 - 1.20*	78.67	21.33	3.76	30.20	254.79	0.71	3.24	38	
1.20 - 1.35	89.62	10.38	3.41	35.79	302.43	0.29	3.37	30	
1.35 - 1.50	91.46	8.54	2.41	37.44	311.97	0.23	3.41	26	
1.50 - 1.65	88.32	11.68	5.13	36.21	310.77	0.32	3.52	34	
Average'	80.87	19.17	3.98	30.76	258.84	0.66	3.19	34	(36)

* Composite

' Weighted seam average

() Coke Stability based on seam averages of Balance and Strength Indices.

TABLE III.30 Coke stability calculations for the Phalen Seam, Phalen Colliery.

INTERVAL (m)	% TOTAL REACTIVES	% TOTAL INERTS	PARR'S MIN.MAT.	OPTIMUM INERT	OPTIMUM STRENGTH	BALANCE INDEX	STRENGTH INDEX	COKE STABILITY	
Shale Roof									
0.00 - 0.15	83.13	16.87	3.01	30.74	262.81	0.55	3.16	34	
0.15 - 0.30	88.14	11.86	3.36	32.99	278.81	0.36	3.16	27	
0.30 - 0.45	87.14	12.86	2.90	33.82	291.81	0.38	3.35	33	
0.45 - 0.93*	86.92	13.08	4.58	33.20	285.32	0.39	3.28	32	
0.93 - 2.13*	84.58	15.42	3.99	32.99	291.13	0.47	3.44	38	
2.13 - 2.28	71.83	28.17	4.44	27.00	246.64	1.04	3.43	44	
2.28 - 2.48	85.75	14.25	4.29	32.36	277.13	0.44	3.23	33	
2.48 - 2.53									
2.53 - 2.73	81.43	18.57	8.14	30.56	269.52	0.61	3.31	39	
Average'	84.40	15.60	4.30	32.38	282.71	0.49	3.35	36	(37)
Sandstone Roof									
0.00 - 0.15	71.17	28.83	9.57	26.07	225.67	1.11	3.17	38	
0.15 - 0.30	76.37	23.63	5.29	29.61	273.87	0.80	3.59	47	
0.30 - 0.45	87.15	12.85	2.83	33.85	293.70	0.38	3.37	34	
0.45 - 1.35*	83.26	16.74	2.58	32.46	290.59	0.52	3.49	41	
1.35 - 1.45	82.17	17.83	6.34	31.63	285.72	0.56	3.48	41	
1.45 - 1.50									
1.50 - 1.65	82.90	17.10	5.87	32.10	289.34	0.53	3.49	41	
1.65 - 1.95	69.89	30.11	17.61	26.94	254.11	1.12	3.64	48	
Average'	75.55	19.19	5.86	29.23	263.24	0.65	3.30	40	(39)

* Composite

' Weighted seam average

() Coke Stability based on seam averages of Balance and Strength Indices.

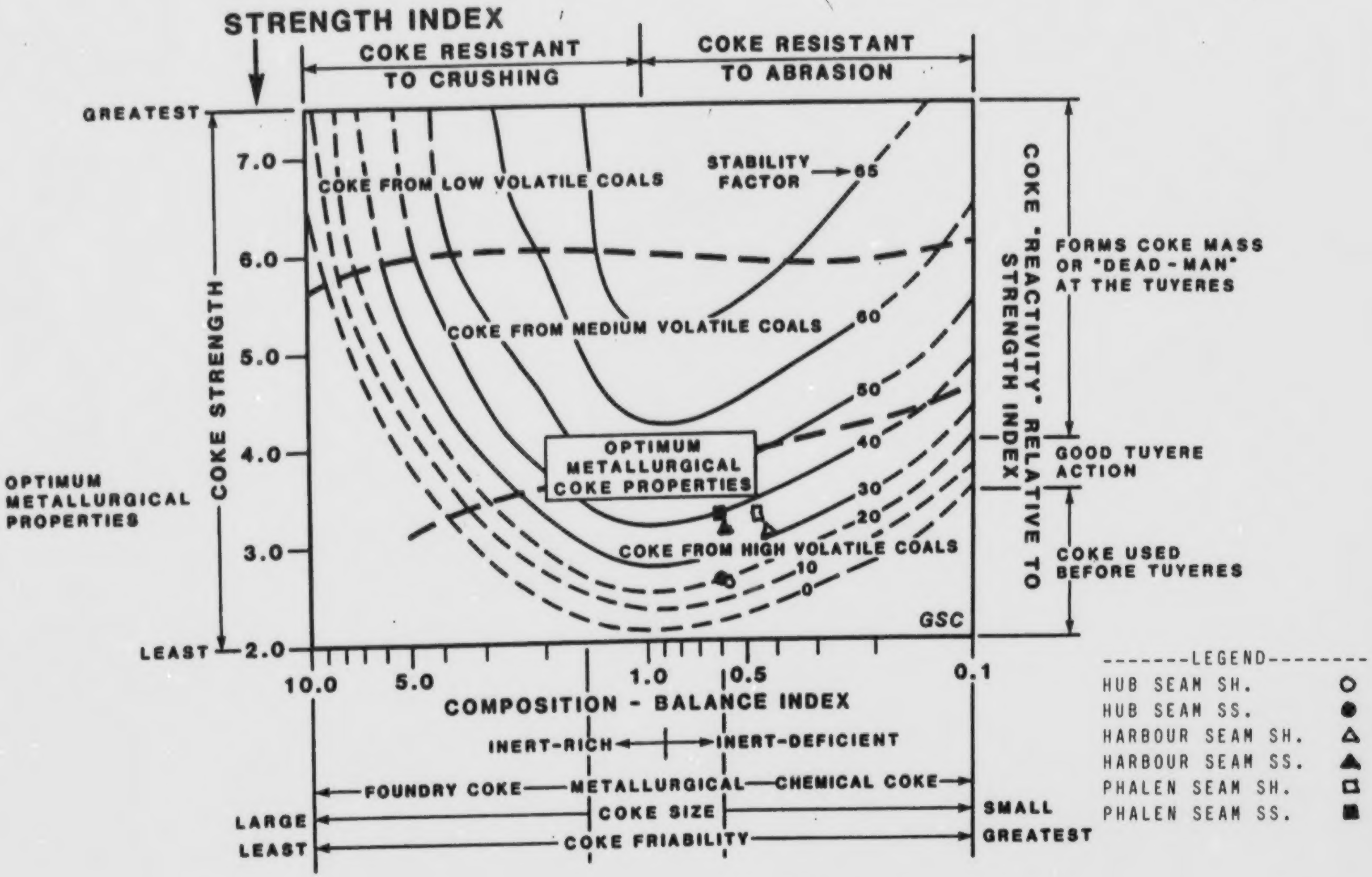


FIGURE III.4 Coke Stability calculations - Sydney Basin.

APPENDIX III

B. Coal Petrography

ii) Vitrinite Reflectance

APPENDIX III. B. Coal Petrography

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FIGURE III.10 a-g Vitrinite reflectance histograms - Phalen seam, sandstone roof

TABLE III.31

Vitrinite Reflectance Data Points

Hub Seam - Shale Roof

```
0.00 - 0.08m

 0.64   0.65   0.65   0.66   0.66   0.67   0.68   0.68   0.68   0.68   0.69
 0.69   0.69   0.70   0.70   0.70   0.70   0.70   0.70   0.71   0.71   0.71
 0.71   0.71   0.71   0.71   0.72   0.72   0.72   0.72   0.73   0.73   0.73
 0.73   0.73   0.73   0.73   0.73   0.73   0.73   0.73   0.74   0.74   0.75
 0.75   0.75   0.75   0.77   0.77   0.78

POPULATION 1 RANGES FROM .6 TO .799
MEAN = .71
STANDARD DEVIATION = .032
NUMBER OF POINTS = 50


0.08 - 0.23m

 0.65   0.67   0.70   0.70   0.71   0.71   0.71   0.71   0.72   0.72   0.72
 0.72   0.73   0.73   0.73   0.74   0.74   0.74   0.74   0.74   0.74   0.74
 0.75   0.75   0.75   0.75   0.75   0.75   0.75   0.75   0.75   0.76   0.76
 0.77   0.77   0.77   0.78   0.78   0.78   0.78   0.79   0.79   0.79   0.79
 0.80   0.81   0.81   0.81   0.81   0.82

POPULATION 1 RANGES FROM .65 TO .849
MEAN = .75
STANDARD DEVIATION = .037
NUMBER OF POINTS = 50


0.23 - 0.38m

 0.66   0.69   0.71   0.71   0.71   0.72   0.72   0.72   0.73   0.73   0.74
 0.74   0.74   0.74   0.74   0.74   0.75   0.75   0.75   0.75   0.75   0.75
 0.76   0.76   0.76   0.76   0.76   0.76   0.76   0.77   0.77   0.77   0.77
 0.77   0.77   0.78   0.78   0.78   0.78   0.79   0.79   0.79   0.79   0.80
 0.81   0.81   0.82   0.82   0.84   0.85

POPULATION 1 RANGES FROM .65 TO .899
MEAN = .76
STANDARD DEVIATION = .037
NUMBER OF POINTS = 50


0.38 - 1.28m

 0.70   0.71   0.72   0.73   0.73   0.73   0.74   0.74   0.74   0.74   0.75
 0.75   0.75   0.75   0.75   0.76   0.76   0.76   0.76   0.76   0.77   0.77
 0.78   0.78   0.78   0.78   0.79   0.79   0.79   0.79   0.80   0.80   0.80
 0.80   0.80   0.80   0.81   0.81   0.82   0.82   0.83   0.84   0.84   0.84
 0.85   0.86   0.86   0.87   0.88   0.89

POPULATION 1 RANGES FROM .7 TO .899
MEAN = .79
STANDARD DEVIATION = .046
NUMBER OF POINTS = 50
```

TABLE III.31

Vitrinite Reflectance Data Points

Hub Seam - Shale Roof

1.28 - 2.03m

0.69	0.71	0.71	0.74	0.74	0.74	0.74	0.74	0.75	0.75	0.75
0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.76	0.76	0.76	0.76
0.76	0.76	0.76	0.76	0.77	0.77	0.77	0.77	0.78	0.78	0.78
0.78	0.79	0.79	0.79	0.79	0.80	0.80	0.80	0.80	0.81	0.81
0.81	0.82	0.82	0.83	0.83	0.84					

POPULATION 1 RANGES FROM .65 TO .849
MEAN = .77
STANDARD DEVIATION = .032
NUMBER OF POINTS = 50

2.03 - 2.18m

0.66	0.67	0.68	0.69	0.69	0.69	0.70	0.70	0.71	0.71	0.71
0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.73	0.73	0.73
0.73	0.73	0.73	0.74	0.74	0.74	0.74	0.74	0.75	0.75	0.75
0.75	0.75	0.75	0.76	0.76	0.77	0.77	0.77	0.77	0.77	0.78
0.78	0.78	0.78	0.78	0.79	0.80					

POPULATION 1 RANGES FROM .65 TO .849
MEAN = .74
STANDARD DEVIATION = .033
NUMBER OF POINTS = 50

2.18 - 2.33m

0.65	0.68	0.69	0.69	0.69	0.69	0.70	0.70	0.70	0.70	0.70
0.70	0.71	0.71	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.72
0.72	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.74
0.74	0.74	0.74	0.74	0.74	0.75	0.75	0.75	0.75	0.75	0.75
0.76	0.76	0.76	0.76	0.77	0.77					

POPULATION 1 RANGES FROM .65 TO .799
MEAN = .73
STANDARD DEVIATION = .026
NUMBER OF POINTS = 50

2.33 - 2.43m

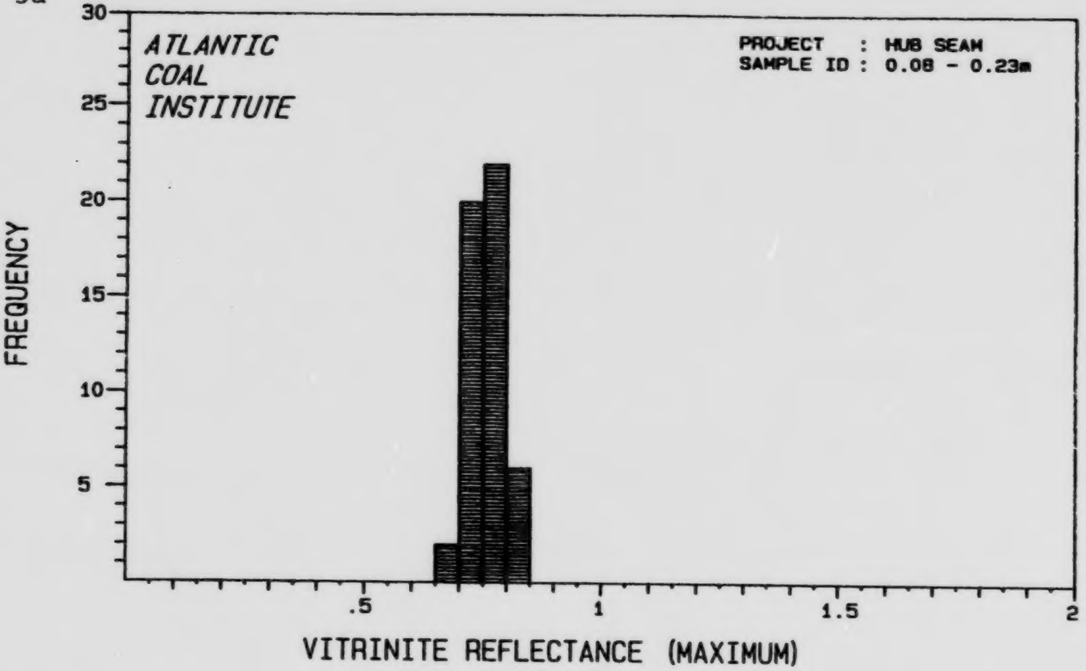
0.62	0.62	0.65	0.67	0.67	0.68	0.68	0.68	0.68	0.69	0.69
0.70	0.70	0.70	0.70	0.70	0.71	0.71	0.71	0.71	0.71	0.71
0.71	0.71	0.71	0.71	0.71	0.72	0.72	0.72	0.72	0.72	0.72
0.72	0.72	0.72	0.73	0.73	0.73	0.74	0.74	0.75	0.75	0.75
0.75	0.75	0.75	0.75	0.76	0.78					

POPULATION 1 RANGES FROM .6 TO .799
MEAN = .71
STANDARD DEVIATION = .032
NUMBER OF POINTS = 50

POPULATION	MEAN	STANDARD DEVIATION	# OF POINTS
▤ 1	.75	.037	50

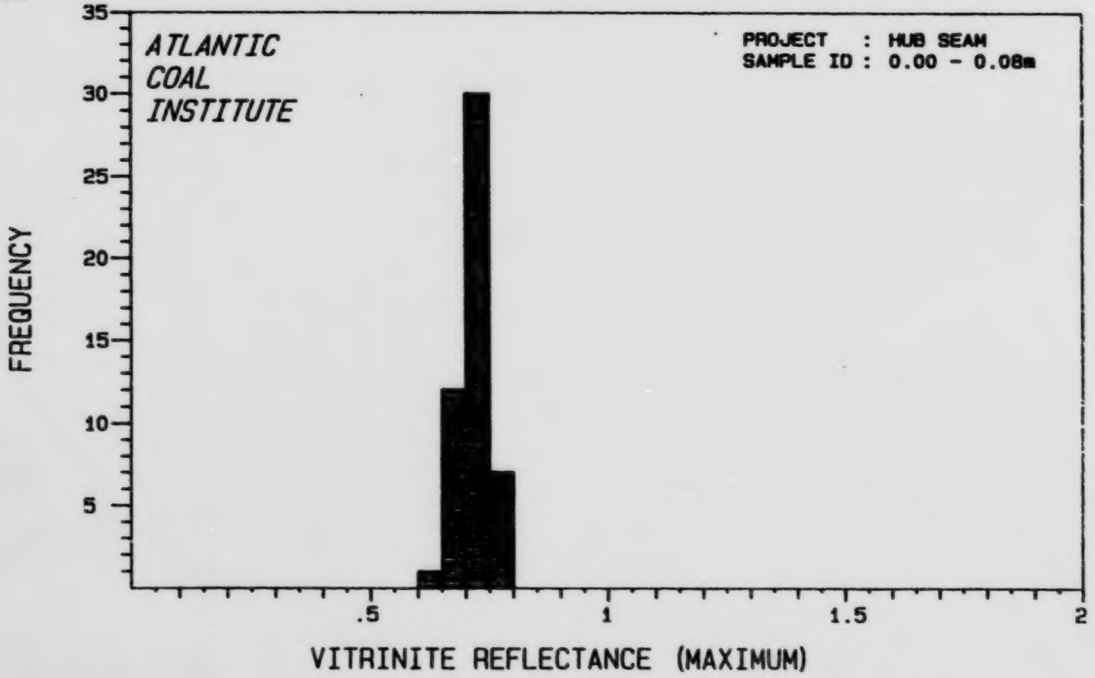
FIGURE III.5

5a



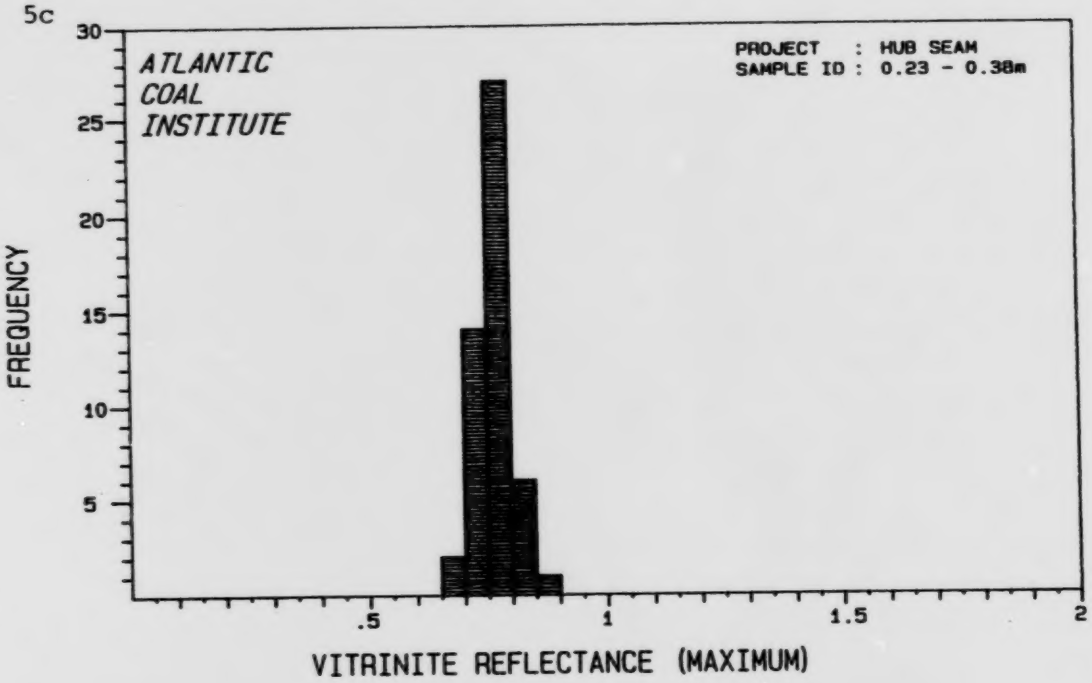
POPULATION	MEAN	STANDARD DEVIATION	# OF POINTS
▤ 1	.71	.032	50

5b



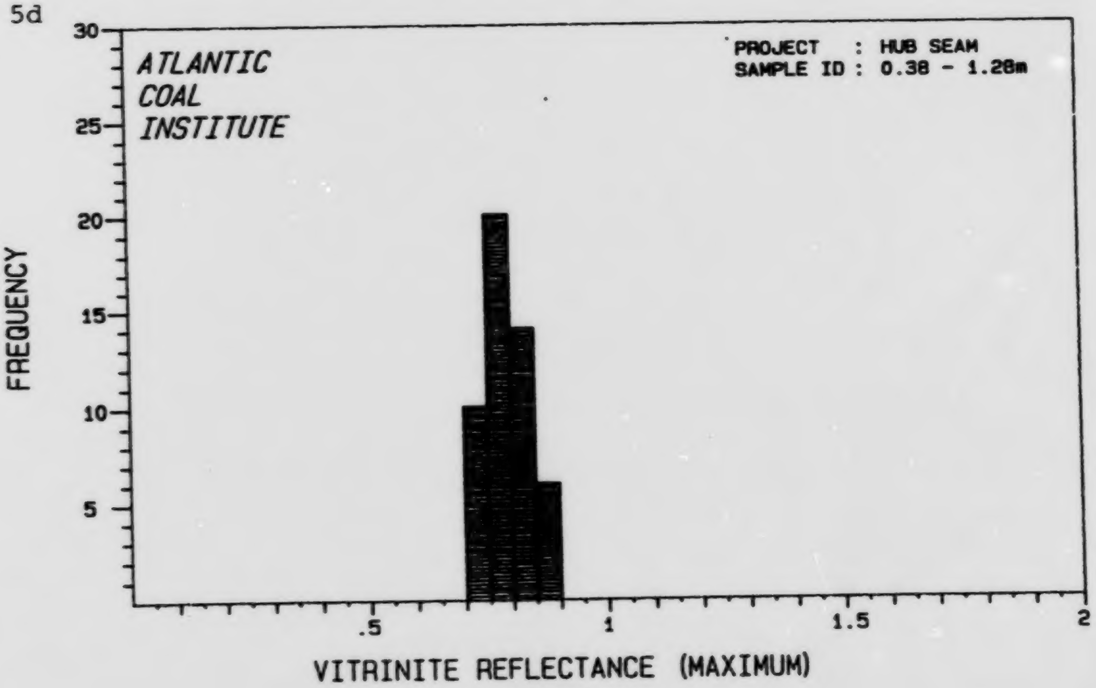
POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.76	.037	50

5c



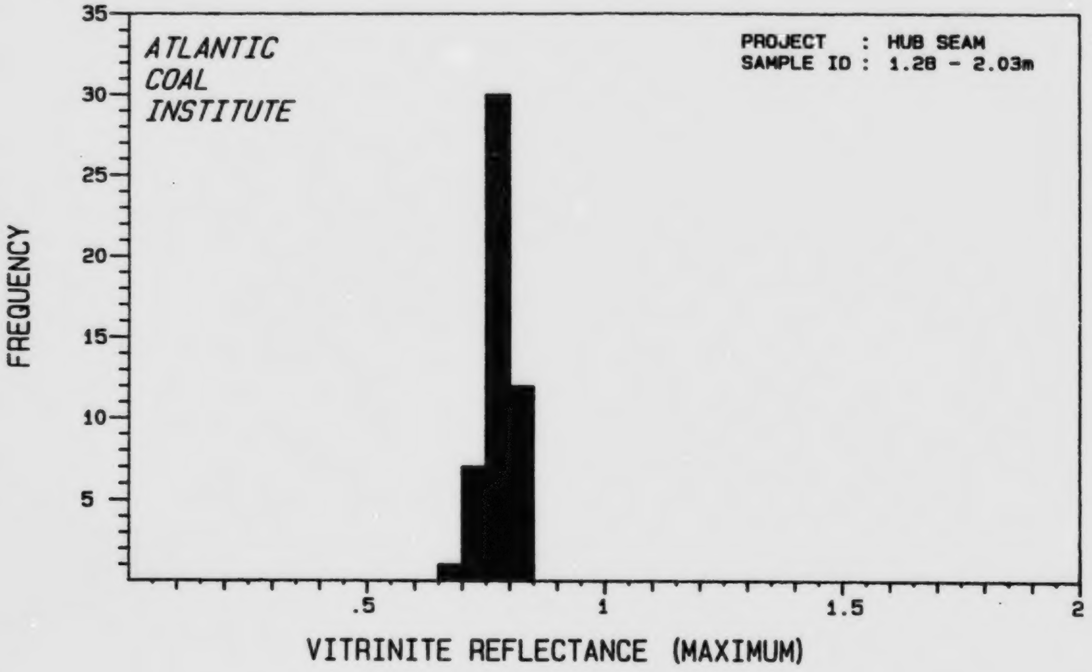
POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.79	.046	50

5d



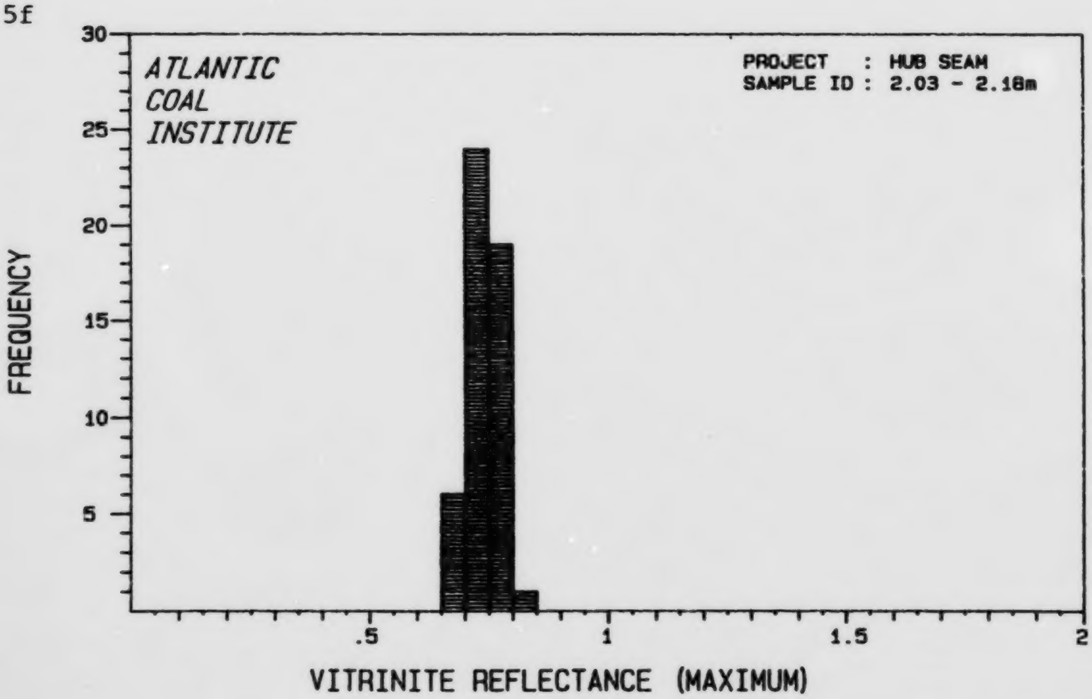
POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.77	.032	50

5e



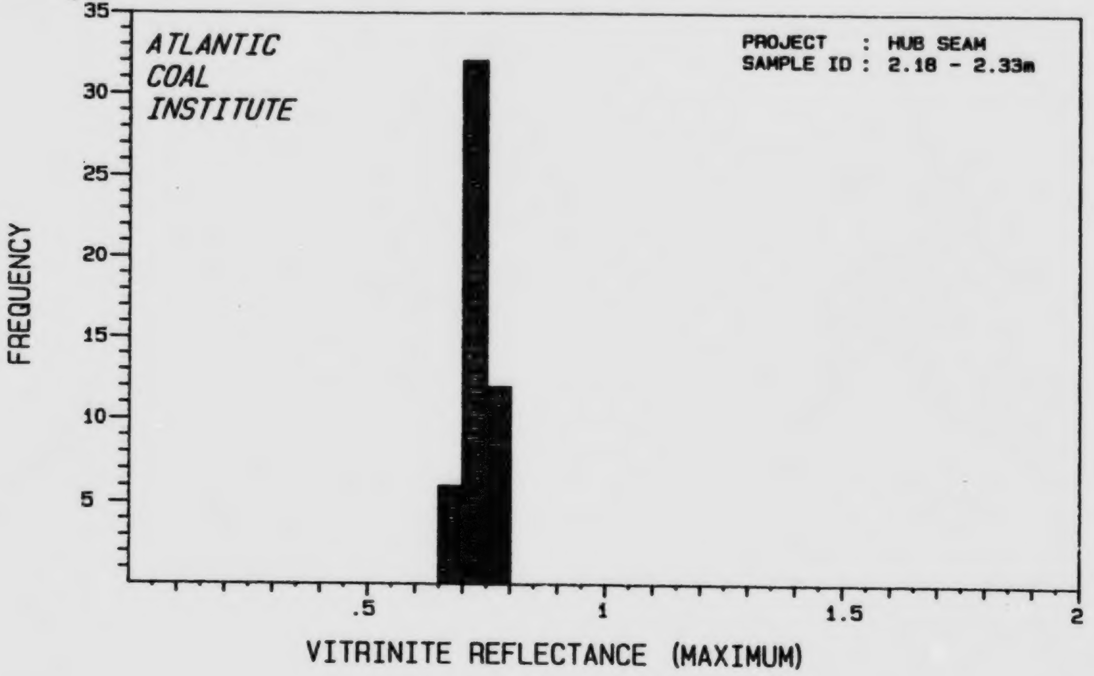
POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.74	.033	50

5f



POPULATION	MEAN	STANDARD DEVIATION	# OF POINTS
▤ 1	.73	.026	50

5g



POPULATION	MEAN	STANDARD DEVIATION	# OF POINTS
▤ 1	.71	.032	50

5h

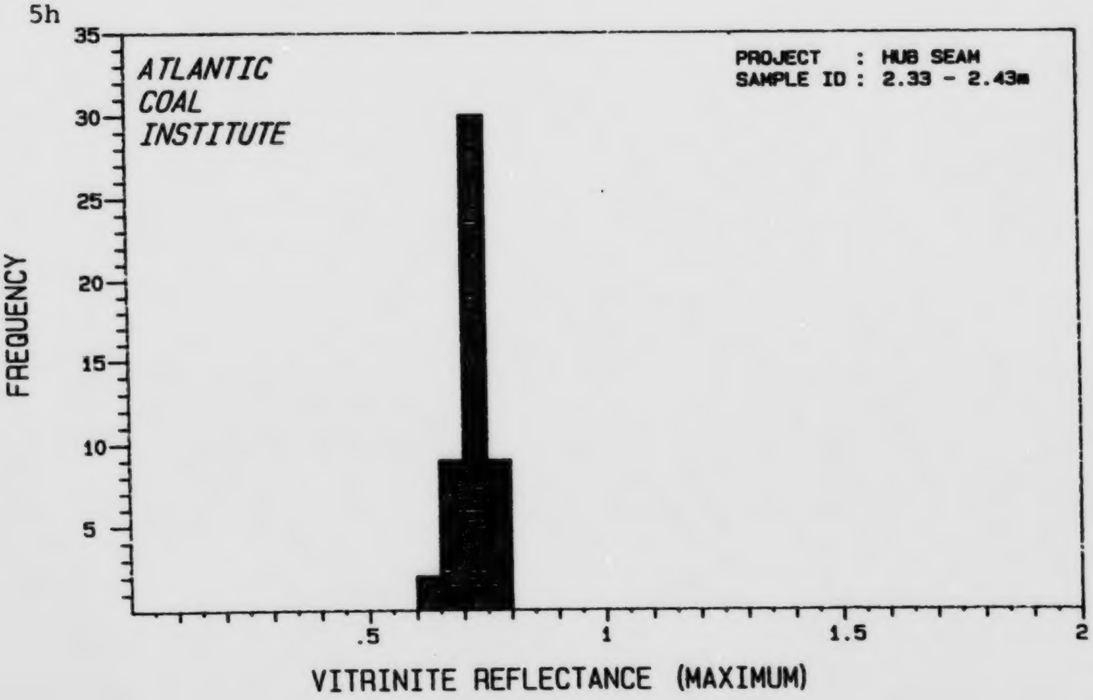


TABLE III.32

Vitrinite Reflectance Data Points

Hub Seam - Sandstone Roof

```
0.00 - 0.15m

 0.64   0.66   0.67   0.69   0.69   0.70   0.70   0.71   0.71   0.72   0.72
 0.72   0.72   0.72   0.72   0.72   0.73   0.73   0.73   0.73   0.73   0.74
 0.74   0.74   0.74   0.74   0.74   0.74   0.75   0.75   0.75   0.75   0.75
 0.76   0.76   0.76   0.76   0.76   0.76   0.76   0.76   0.76   0.77   0.77
 0.77   0.78   0.78   0.78   0.78   0.79

POPULATION 1 RANGES FROM .6 TO .799
MEAN = .74
STANDARD DEVIATION = .032
NUMBER OF POINTS = 50


0.15 - 0.30m

 0.66   0.67   0.69   0.71   0.71   0.72   0.72   0.72   0.72   0.72   0.72
 0.72   0.73   0.73   0.73   0.73   0.74   0.74   0.74   0.74   0.75   0.75
 0.75   0.76   0.76   0.76   0.76   0.76   0.76   0.76   0.76   0.76   0.77
 0.77   0.77   0.77   0.78   0.78   0.78   0.78   0.79   0.79   0.79   0.79
 0.80   0.80   0.80   0.81   0.83   0.84

POPULATION 1 RANGES FROM .65 TO .849
MEAN = .75
STANDARD DEVIATION = .037
NUMBER OF POINTS = 50


0.30 - 0.45m

 0.72   0.72   0.74   0.74   0.75   0.75   0.75   0.76   0.76   0.77   0.79
 0.79   0.79   0.79   0.80   0.80   0.80   0.80   0.80   0.81   0.81   0.81
 0.81   0.81   0.81   0.81   0.81   0.81   0.82   0.82   0.82   0.82   0.82
 0.83   0.83   0.83   0.83   0.83   0.83   0.84   0.84   0.84   0.84   0.84
 0.86   0.86   0.88   0.89   0.89   0.91

POPULATION 1 RANGES FROM .7 TO .949
MEAN = .81
STANDARD DEVIATION = .042
NUMBER OF POINTS = 50


0.45 - 1.52m

 0.70   0.73   0.74   0.74   0.75   0.76   0.76   0.76   0.76   0.76   0.77
 0.77   0.77   0.77   0.77   0.78   0.78   0.78   0.78   0.79   0.79   0.79
 0.79   0.80   0.80   0.80   0.80   0.80   0.81   0.81   0.81   0.82   0.82
 0.82   0.83   0.83   0.83   0.84   0.84   0.84   0.85   0.85   0.86   0.86
 0.87   0.87   0.87   0.88   0.91   0.92

POPULATION 1 RANGES FROM .7 TO .949
MEAN = .8
STANDARD DEVIATION = .047
NUMBER OF POINTS = 50
```

TABLE III.32

Vitrinite Reflectance Data Points

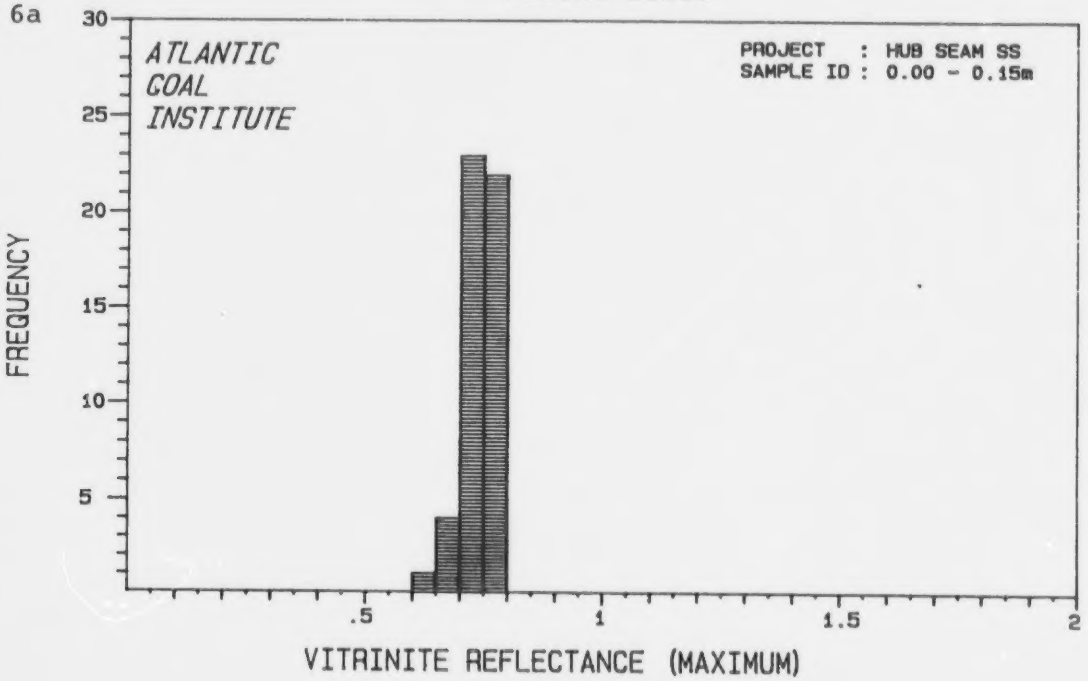
Hub Seam - Sandstone Roof

```
1.53 - 1.68m

 0.75   0.75   0.75   0.75   0.76   0.76   0.76   0.76   0.77   0.77   0.78
 0.78   0.78   0.78   0.78   0.78   0.78   0.78   0.79   0.79   0.79   0.79
 0.79   0.79   0.80   0.80   0.80   0.80   0.81   0.81   0.81   0.81   0.81
 0.81   0.81   0.81   0.82   0.82   0.82   0.82   0.82   0.82   0.82   0.83
 0.83   0.83   0.84   0.85   0.86   0.86

POPULATION 1 RANGES FROM .75 TO .899
MEAN = .8
STANDARD DEVIATION = .028
NUMBER OF POINTS = 50


1.68 - 1.83m

 0.74   0.75   0.75   0.76   0.76   0.76   0.77   0.77   0.77   0.77   0.78
 0.78   0.78   0.78   0.78   0.78   0.78   0.78   0.78   0.79   0.79   0.79
 0.79   0.79   0.79   0.79   0.79   0.79   0.80   0.80   0.80   0.80   0.80
 0.80   0.81   0.81   0.81   0.81   0.82   0.82   0.82   0.83   0.83   0.83
 0.83   0.84   0.84   0.84   0.84   0.86

POPULATION 1 RANGES FROM .7 TO .899
MEAN = .8
STANDARD DEVIATION = .027
NUMBER OF POINTS = 50


1.83 - 1.98m

 0.70   0.70   0.71   0.74   0.75   0.75   0.75   0.75   0.76   0.76   0.76
 0.77   0.77   0.77   0.77   0.78   0.78   0.78   0.78   0.78   0.78   0.78
 0.79   0.79   0.79   0.80   0.80   0.80   0.81   0.81   0.81   0.81   0.81
 0.81   0.81   0.81   0.81   0.81   0.82   0.82   0.82   0.83   0.83   0.83
 0.83   0.84   0.84   0.84   0.85   0.85

POPULATION 1 RANGES FROM .7 TO .899
MEAN = .79
STANDARD DEVIATION = .036
NUMBER OF POINTS = 50
```

POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.74	.032	50

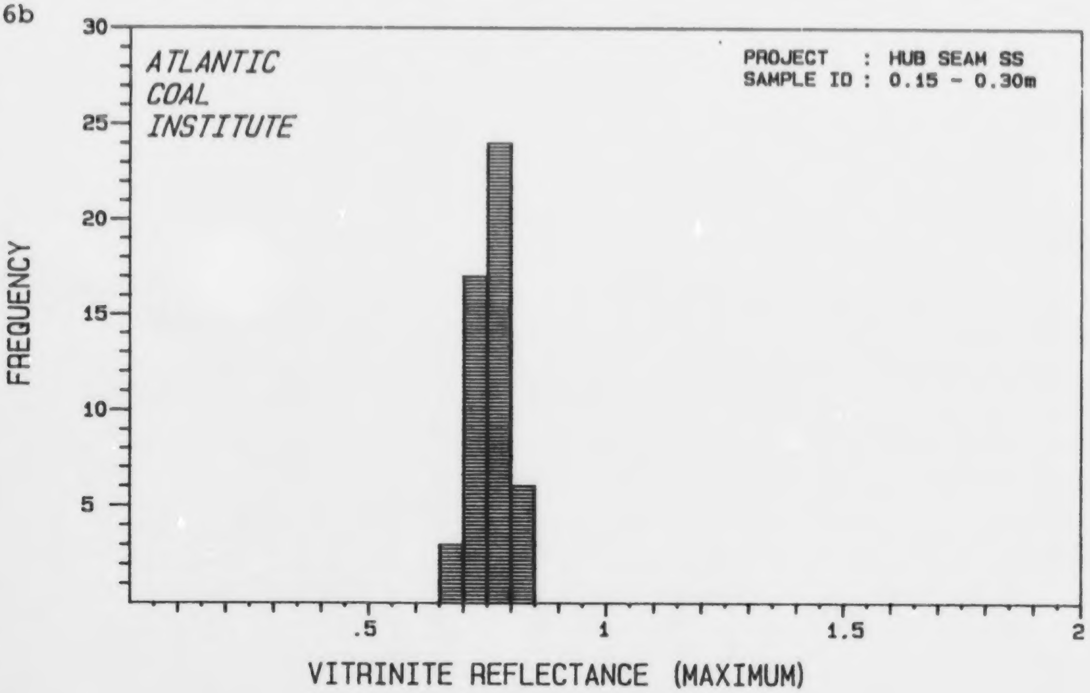
FIGURE III.6

6a



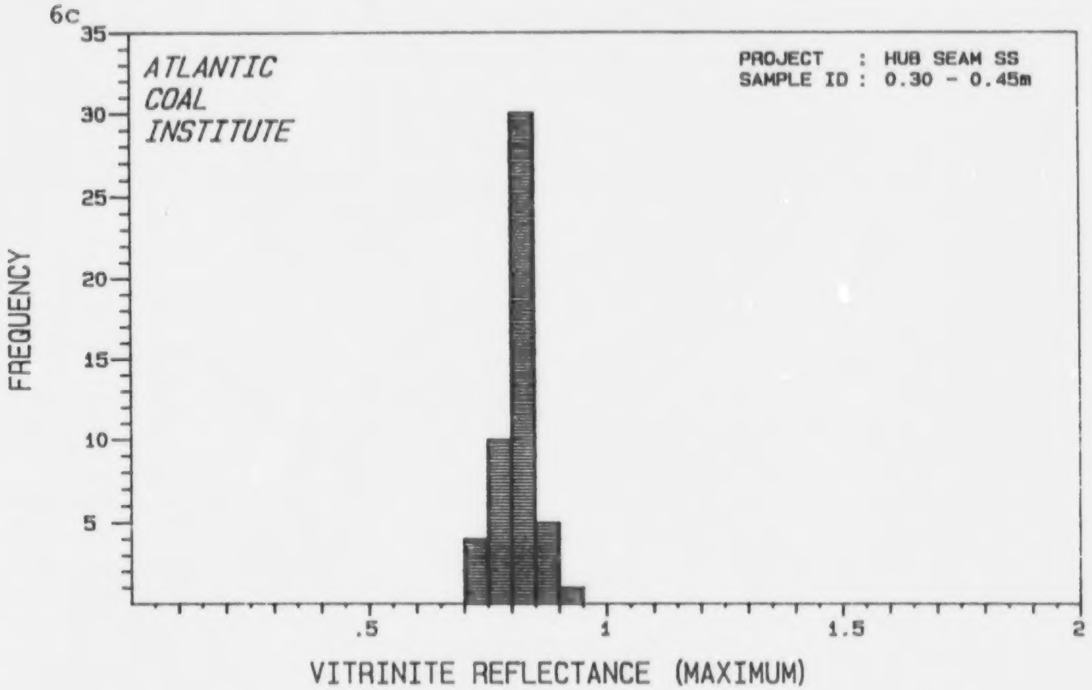
POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.75	.037	50

6b



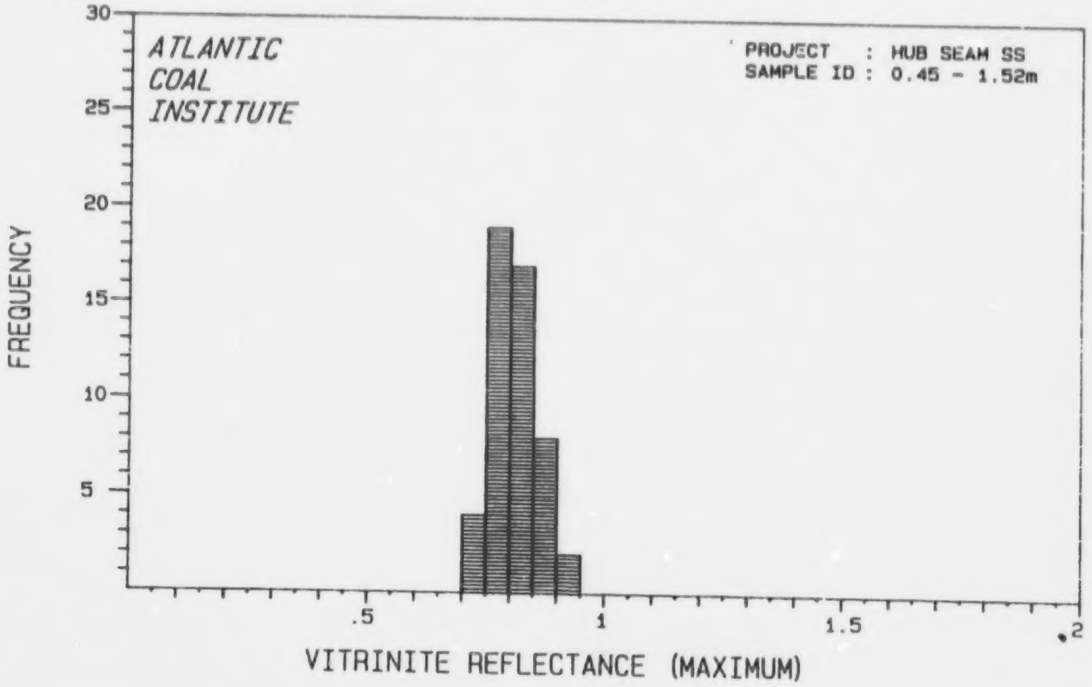
POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.81	.042	50

6c



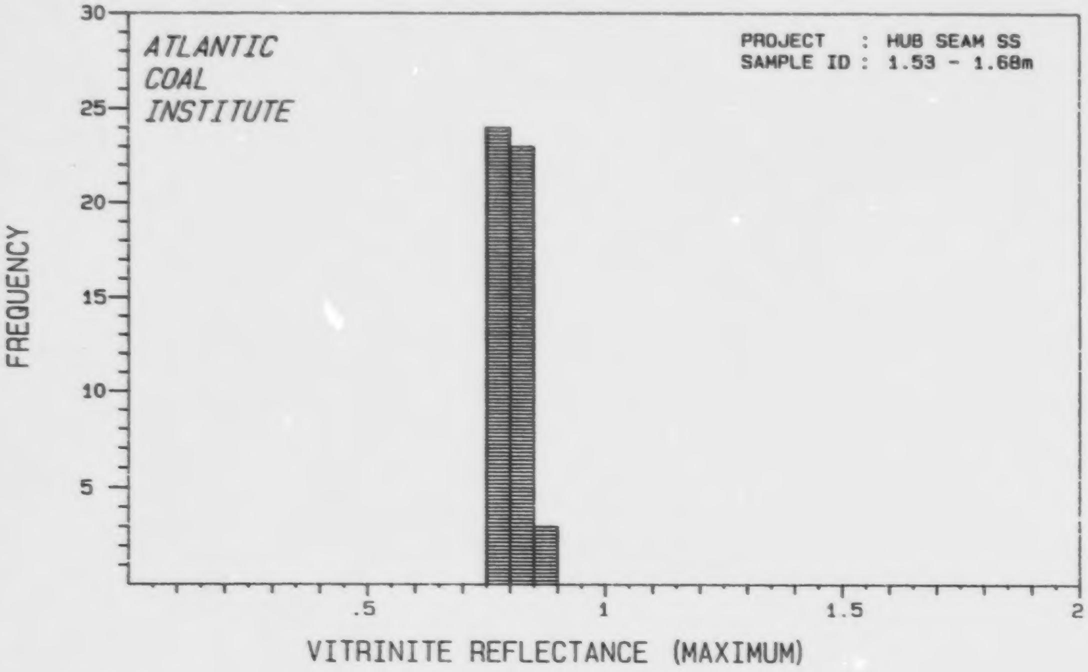
POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.8	.047	50

6d



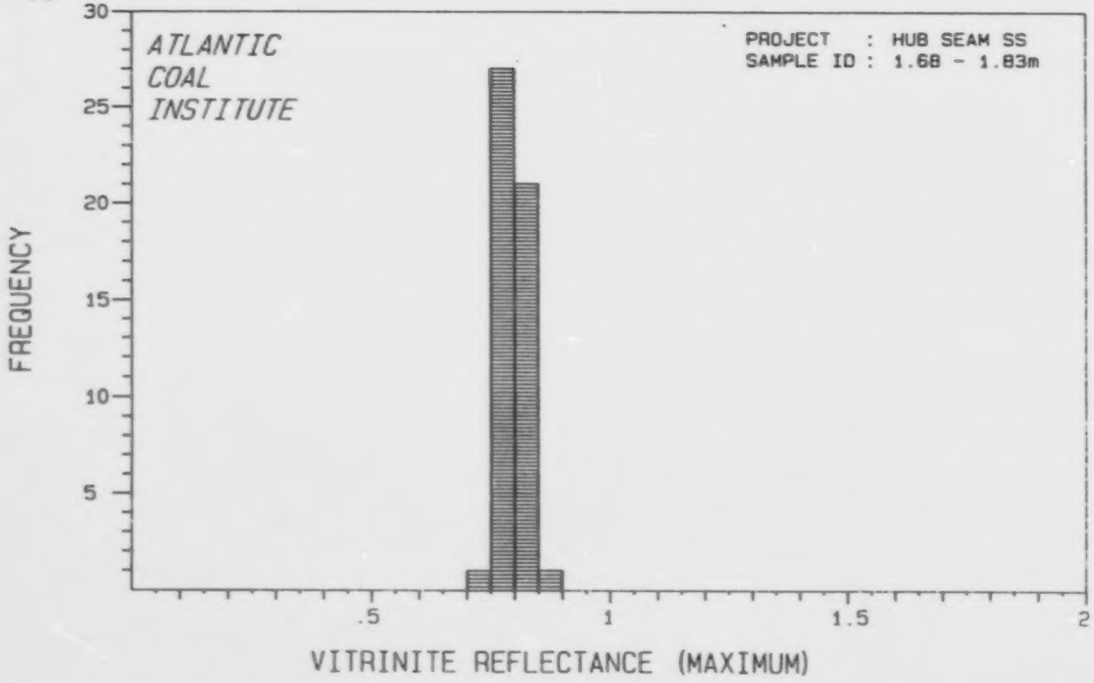
POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.8	.028	50

6e



POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.8	.027	50

6f



POPULATION	MEAN	STANDARD DEVIATION	# OF POINTS
▤ 1	.79	.036	50

6g

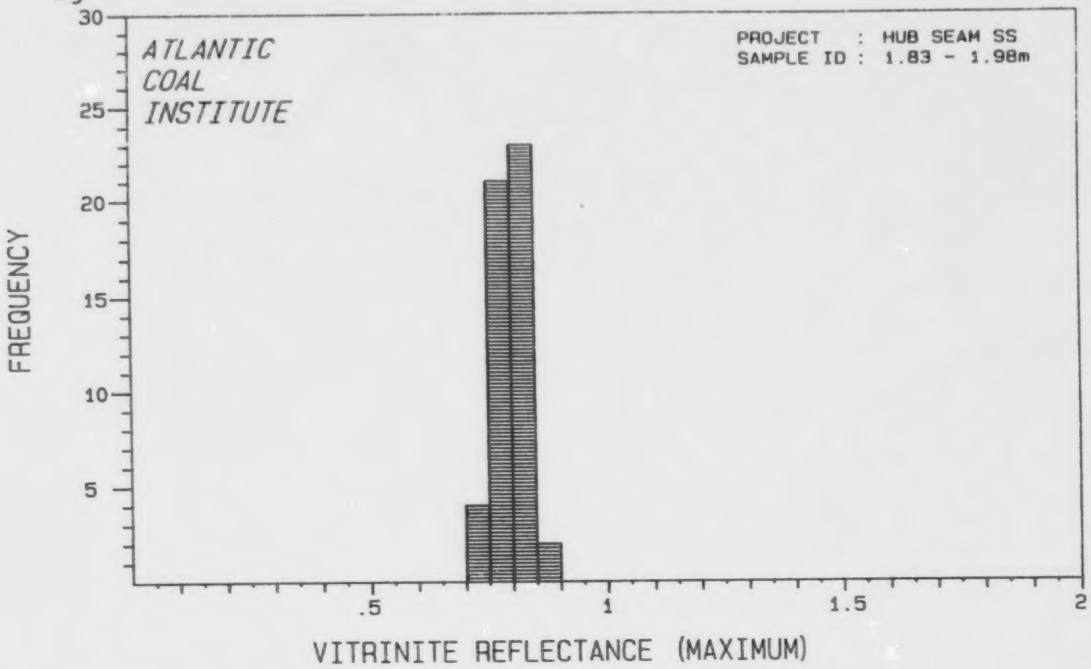


TABLE III.33

Vitrinite Reflectance Data Points

Harbour Seam - Shale Roof

0.00 - 0.15m

0.75	0.81	0.81	0.82	0.82	0.83	0.84	0.84	0.84	0.85	0.85
0.85	0.85	0.85	0.85	0.86	0.86	0.86	0.86	0.86	0.86	0.86
0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.88	0.88
0.88	0.88	0.88	0.89	0.89	0.89	0.89	0.90	0.90	0.91	0.91
0.91	0.92	0.92	0.94	0.94	0.96					

POPULATION 1 RANGES FROM .75 TO .999
MEAN = .87
STANDARD DEVIATION = .037
NUMBER OF POINTS = 50

0.15 - 0.30m

0.87	0.88	0.88	0.89	0.90	0.90	0.91	0.91	0.91	0.91	0.91
0.92	0.92	0.93	0.93	0.93	0.93	0.93	0.94	0.94	0.94	0.94
0.94	0.94	0.94	0.95	0.95	0.95	0.96	0.96	0.96	0.96	0.96
0.96	0.96	0.96	0.96	0.96	0.97	0.97	0.97	0.97	0.98	0.98
0.99	0.99	0.99	1.00	1.00	1.01					

POPULATION 1 RANGES FROM .85 TO 1.049
MEAN = .94
STANDARD DEVIATION = .033
NUMBER OF POINTS = 50

0.30 - 0.45m

0.83	0.84	0.85	0.85	0.87	0.88	0.89	0.89	0.89	0.89	0.89
0.90	0.90	0.90	0.91	0.91	0.91	0.91	0.91	0.92	0.92	0.92
0.92	0.93	0.93	0.93	0.93	0.94	0.94	0.94	0.95	0.95	0.95
0.95	0.95	0.96	0.96	0.97	0.97	0.97	0.97	0.97	0.97	1.00
1.00	1.01	1.02	1.02	1.04	1.04					

POPULATION 1 RANGES FROM .8 TO 1.049
MEAN = .93
STANDARD DEVIATION = .05
NUMBER OF POINTS = 50

0.45 - 1.35m

0.90	0.90	0.92	0.92	0.92	0.92	0.93	0.95	0.95	0.95	0.96
0.96	0.96	0.96	0.97	0.98	0.98	0.98	0.98	0.99	0.99	0.99
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.02	1.02
1.02	1.02	1.04	1.04	1.04	1.04	1.04	1.05	1.05	1.05	1.06
1.07	1.07	1.07	1.07	1.08	1.11					

POPULATION 1 RANGES FROM .9 TO 1.149
MEAN = 1
STANDARD DEVIATION = .051
NUMBER OF POINTS = 50

TABLE III.33

Vitrinite Reflectance Data Points
Harbour Seam - Shale Roof

```
1.35 - 1.50m

 0.96   1.00   1.01   1.01   1.01   1.02   1.02   1.02   1.02   1.02   1.02
 1.03   1.03   1.03   1.03   1.03   1.03   1.03   1.04   1.04   1.04   1.04
 1.04   1.04   1.04   1.05   1.05   1.05   1.05   1.05   1.05   1.06   1.06
 1.06   1.06   1.06   1.06   1.07   1.07   1.07   1.07   1.07   1.08   1.09
 1.09   1.10   1.11   1.11   1.12   1.16

POPULATION 1 RANGES FROM .95 TO 1.199
MEAN = 1.05
STANDARD DEVIATION = .034
NUMBER OF POINTS = 50
```

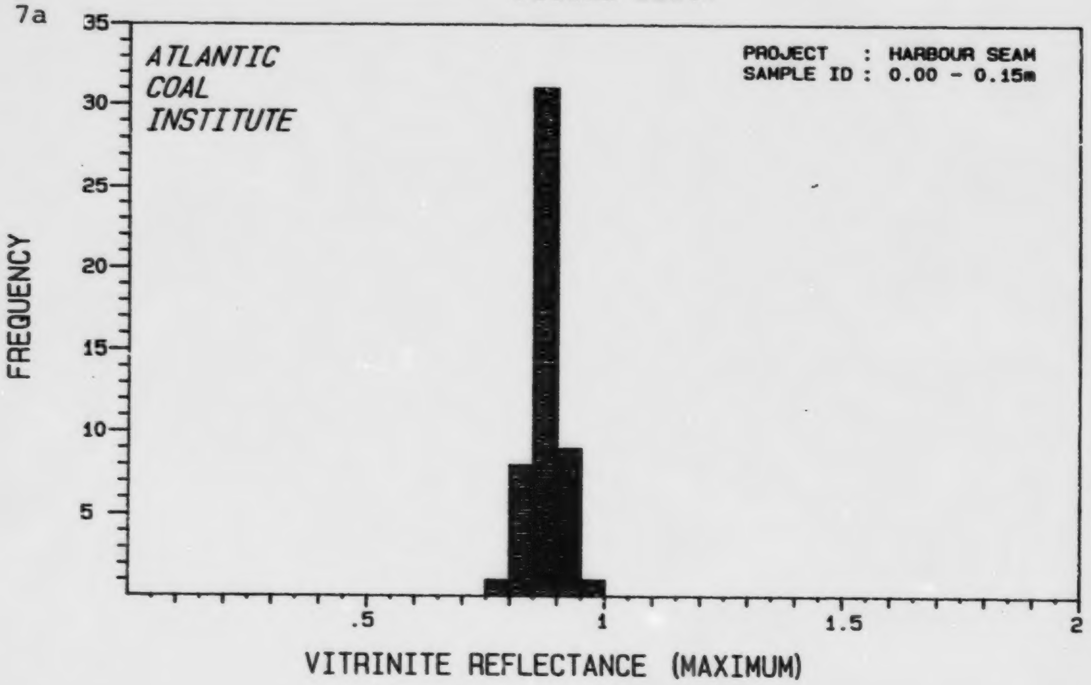
```
1.50 - 1.65m

 0.95   0.95   0.98   0.98   0.98   1.00   1.00   1.01   1.01   1.01   1.02
 1.02   1.02   1.02   1.02   1.03   1.03   1.03   1.03   1.03   1.03   1.03
 1.03   1.03   1.03   1.03   1.03   1.03   1.04   1.04   1.04   1.04   1.04
 1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.06   1.06   1.06
 1.06   1.06   1.07   1.08   1.08   1.10

POPULATION 1 RANGES FROM .95 TO 1.149
MEAN = 1.03
STANDARD DEVIATION = .03
NUMBER OF POINTS = 50
```

```
1.65 - 1.80m

 0.93   0.94   0.94   0.95   0.96   0.96   0.96   0.97   0.97   0.97   0.98
 0.98   0.98   0.98   0.98   0.99   0.99   0.99   0.99   0.99   0.99   0.99
 1.00   1.00   1.00   1.00   1.01   1.01   1.01   1.01   1.01   1.02   1.02
 1.02   1.02   1.02   1.02   1.02   1.03   1.03   1.03   1.04   1.04   1.04
 1.05   1.05   1.05   1.06   1.06   1.07

POPULATION 1 RANGES FROM .9 TO 1.099
MEAN = 1
STANDARD DEVIATION = .034
NUMBER OF POINTS = 50
```

POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.87	.037	50

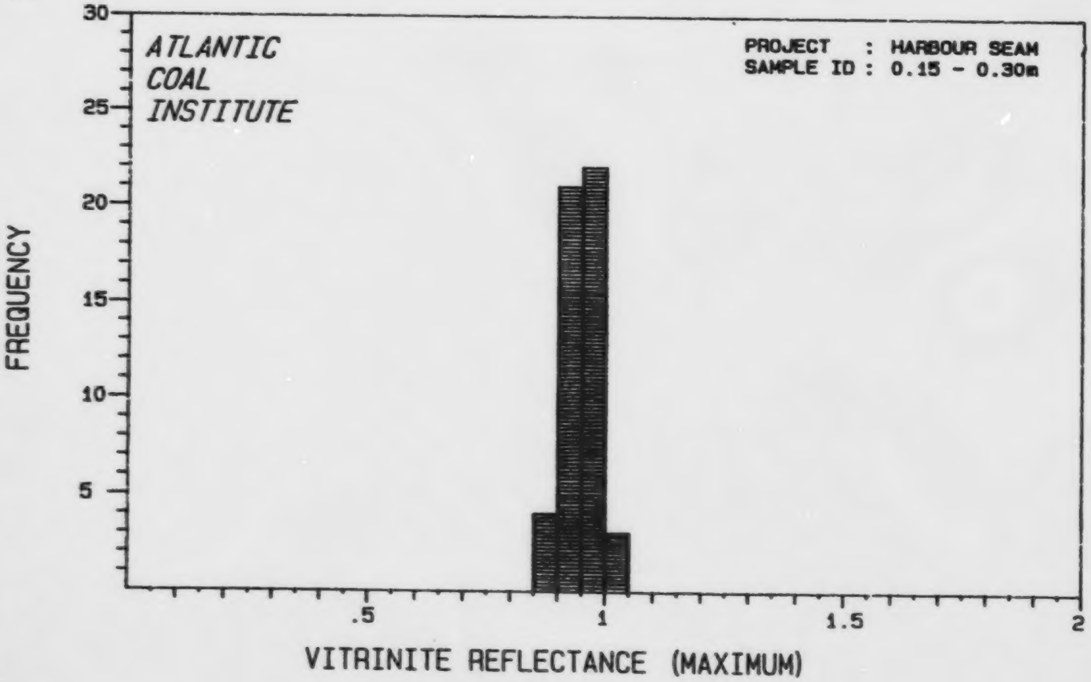
FIGURE III.7

7a



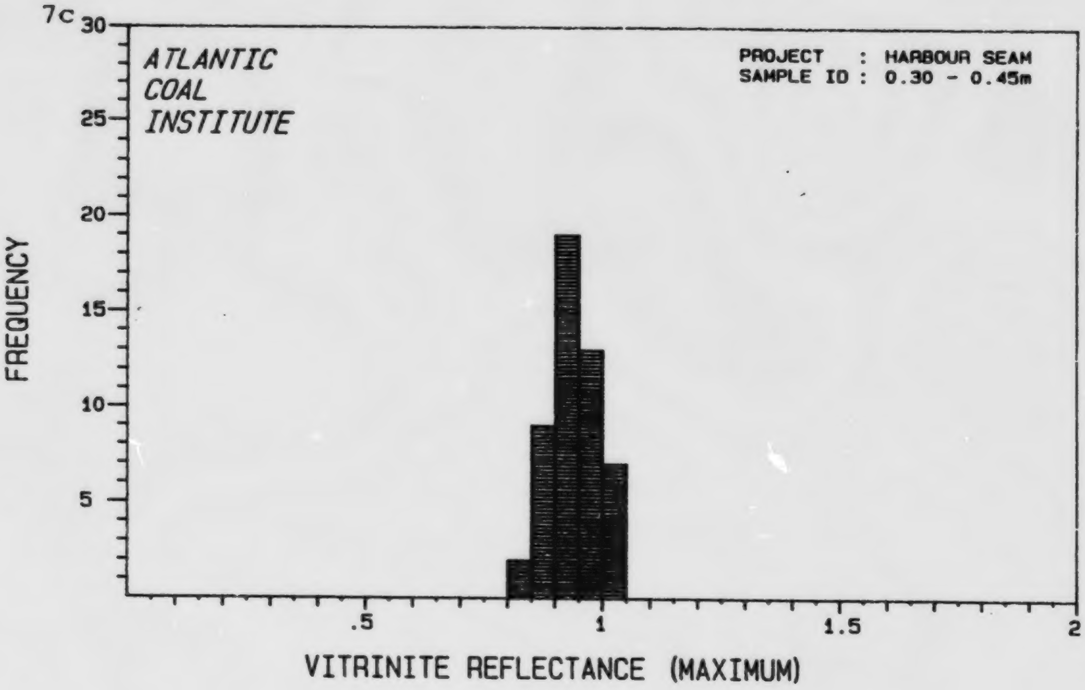
POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.94	.033	50

7b



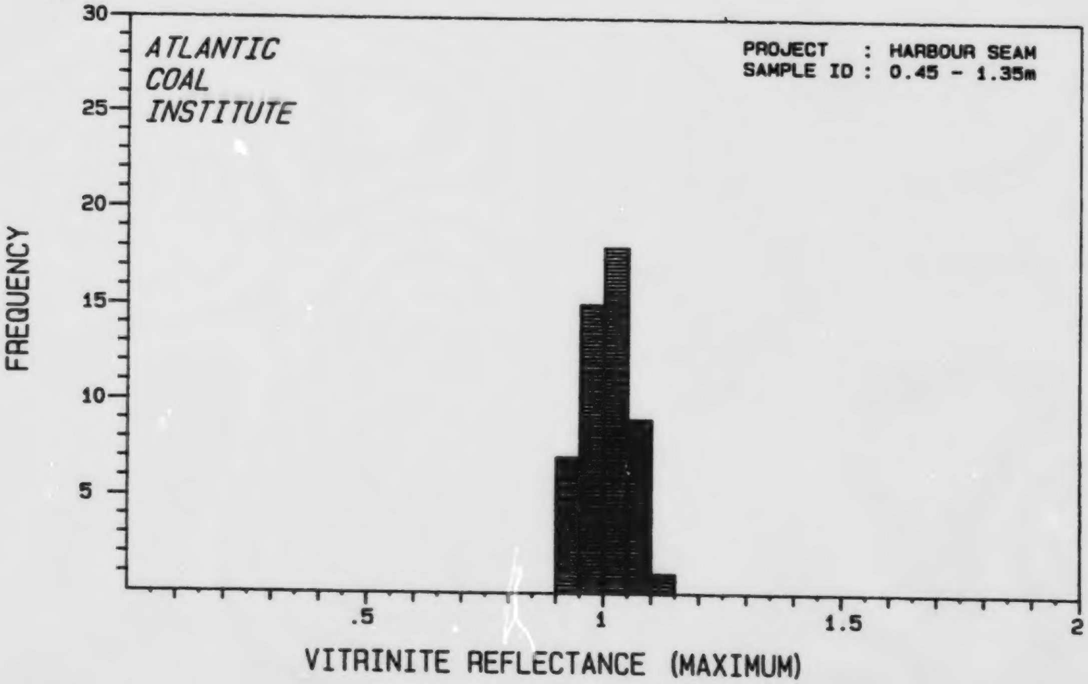
POPULATION	MEAN	STANDARD DEVIATION	# OF POINTS
▤ 1	.93	.050	50

7c



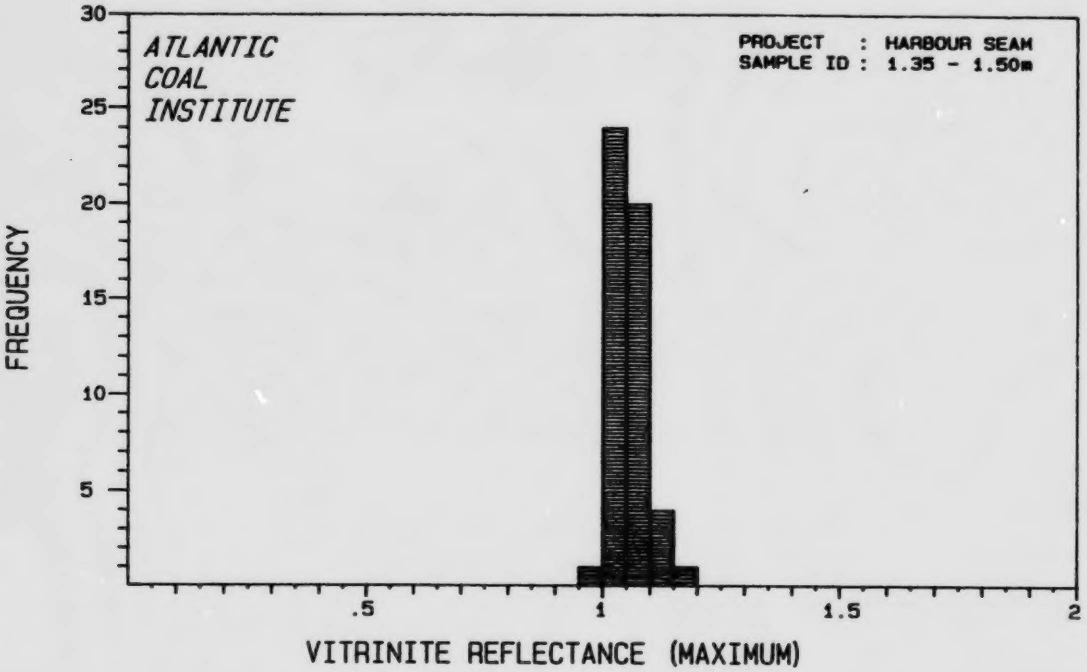
POPULATION	MEAN	STANDARD DEVIATION	# OF POINTS
▤ 1	1	.051	50

7d



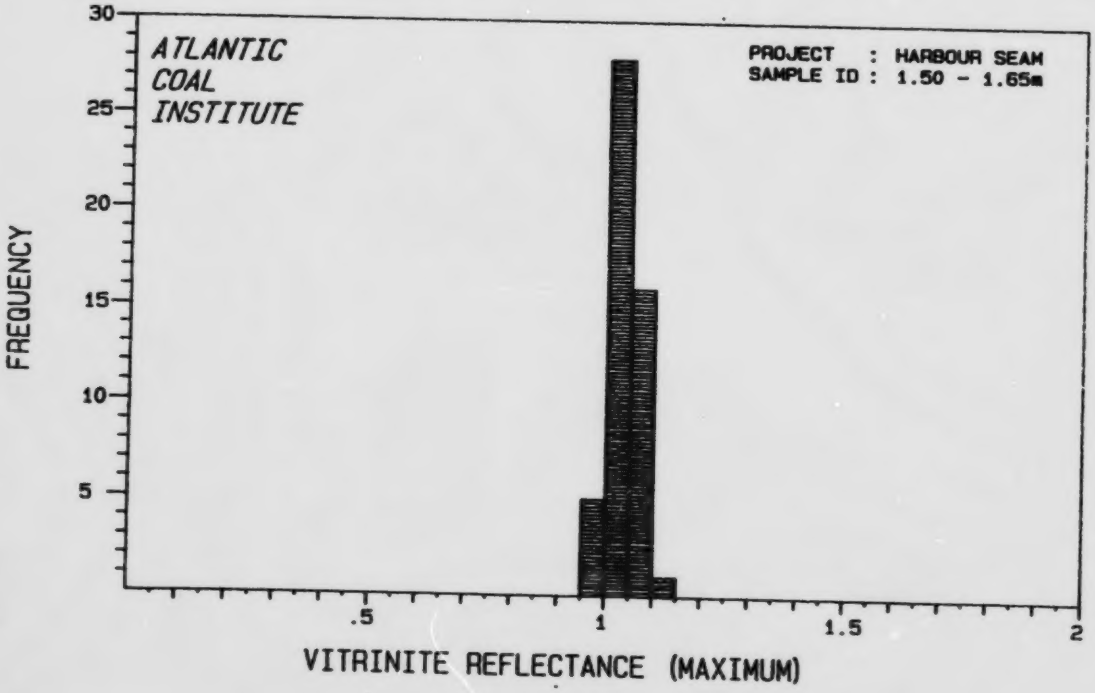
POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	1.05	.034	50

7e



POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	1.03	.030	50

7f



POPULATION	MEAN	STANDARD DEVIATION	# OF POINTS
▤ 1	1	.034	50

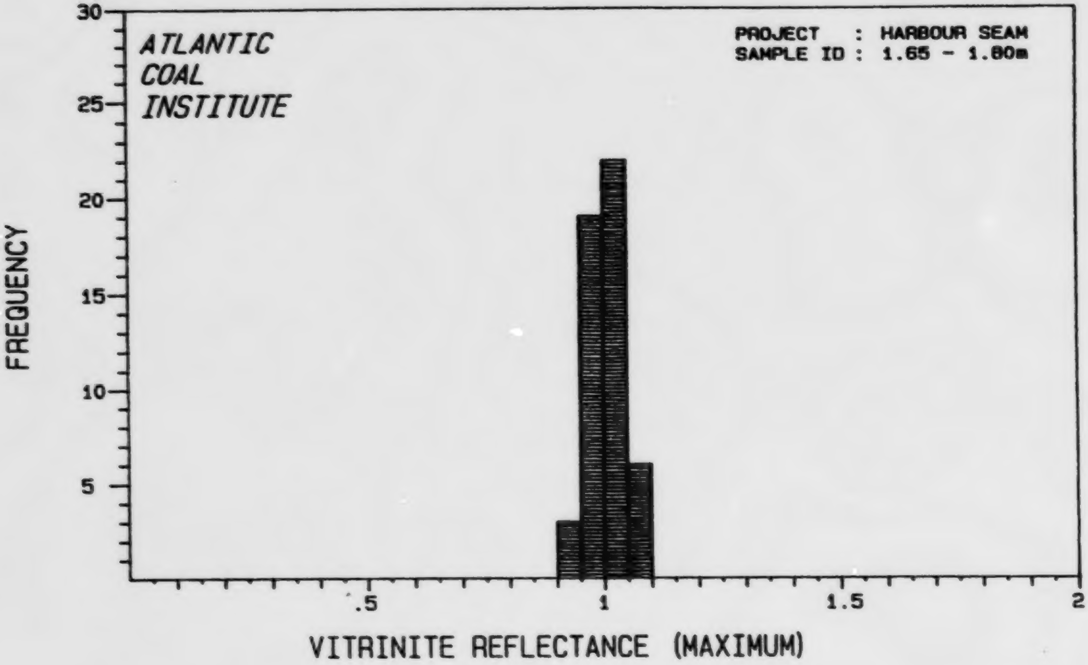


TABLE III.34

Vitrinite Reflectance Data Points
Harbour Seam - Sandstone Roof

```
0.00 - 0.15m

 0.73   0.74   0.75   0.75   0.76   0.76   0.77   0.78   0.78   0.78   0.79
 0.79   0.79   0.79   0.79   0.80   0.80   0.80   0.80   0.81   0.81   0.81
 0.81   0.82   0.82   0.82   0.82   0.82   0.82   0.82   0.82   0.83   0.83
 0.83   0.83   0.84   0.84   0.84   0.84   0.84   0.85   0.85   0.85   0.85
 0.85   0.86   0.86   0.86   0.87   0.87

POPULATION 1 RANGES FROM .7 TO .899
MEAN = .81
STANDARD DEVIATION = .035
NUMBER OF POINTS = 50


0.15 - 0.30m

 0.71   0.73   0.75   0.75   0.75   0.75   0.76   0.76   0.76   0.77   0.77
 0.78   0.78   0.78   0.78   0.79   0.79   0.79   0.79   0.80   0.80   0.80
 0.81   0.81   0.82   0.82   0.82   0.82   0.82   0.82   0.82   0.82   0.82
 0.83   0.83   0.83   0.83   0.83   0.84   0.84   0.84   0.85   0.85   0.86
 0.86   0.86   0.87   0.87   0.88   0.88

POPULATION 1 RANGES FROM .7 TO .899
MEAN = .81
STANDARD DEVIATION = .04
NUMBER OF POINTS = 50


0.30 - 0.45m

 0.72   0.73   0.73   0.74   0.74   0.74   0.75   0.75   0.75   0.76   0.76
 0.76   0.76   0.77   0.77   0.77   0.77   0.77   0.77   0.77   0.78   0.78
 0.78   0.79   0.79   0.79   0.80   0.80   0.80   0.80   0.80   0.81   0.81
 0.81   0.81   0.81   0.81   0.82   0.82   0.82   0.82   0.82   0.82   0.83
 0.84   0.84   0.84   0.85   0.86   0.86

POPULATION 1 RANGES FROM .7 TO .899
MEAN = .79
STANDARD DEVIATION = .036
NUMBER OF POINTS = 50


0.45 - 1.20m

 0.80   0.83   0.85   0.88   0.89   0.89   0.90   0.90   0.90   0.91   0.91
 0.91   0.92   0.92   0.92   0.92   0.93   0.93   0.94   0.94   0.94   0.95
 0.95   0.95   0.95   0.95   0.95   0.96   0.96   0.96   0.96   0.97   0.97
 0.97   0.97   0.97   0.97   0.97   0.98   0.98   0.98   0.98   0.98   0.99
 0.99   0.99   1.00   1.00   1.01   1.02

POPULATION 1 RANGES FROM .8 TO 1.049
MEAN = .94
STANDARD DEVIATION = .045
NUMBER OF POINTS = 50
```

TABLE III.34

Vitrinite Reflectance Data Points

Harbour Seam - Sandstone Roof

1.20 - 1.35m

0.92	0.93	0.93	0.93	0.94	0.95	0.95	0.95	0.95	0.96	0.96
0.96	0.97	0.97	0.97	0.97	0.98	0.98	0.98	0.98	0.99	0.99
0.99	0.99	0.99	0.99	0.99	1.00	1.00	1.00	1.01	1.01	1.01
1.01	1.01	1.01	1.01	1.02	1.02	1.02	1.02	1.02	1.03	1.03
1.03	1.04	1.04	1.04	1.05	1.06					

POPULATION 1 RANGES FROM .9 TO 1.099
MEAN = .99
STANDARD DEVIATION = .034
NUMBER OF POINTS = 50

1.35 - 1.50m

0.97	0.97	0.97	0.97	0.98	0.99	0.99	0.99	0.99	0.99	1.00
1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01
1.02	1.02	1.02	1.02	1.02	1.03	1.03	1.03	1.03	1.03	1.04
1.04	1.04	1.04	1.04	1.04	1.04	1.05	1.05	1.05	1.05	1.06
1.06	1.07	1.07	1.08	1.08	1.10					

POPULATION 1 RANGES FROM .95 TO 1.149
MEAN = 1.02
STANDARD DEVIATION = .031
NUMBER OF POINTS = 50

1.50 - 1.65m

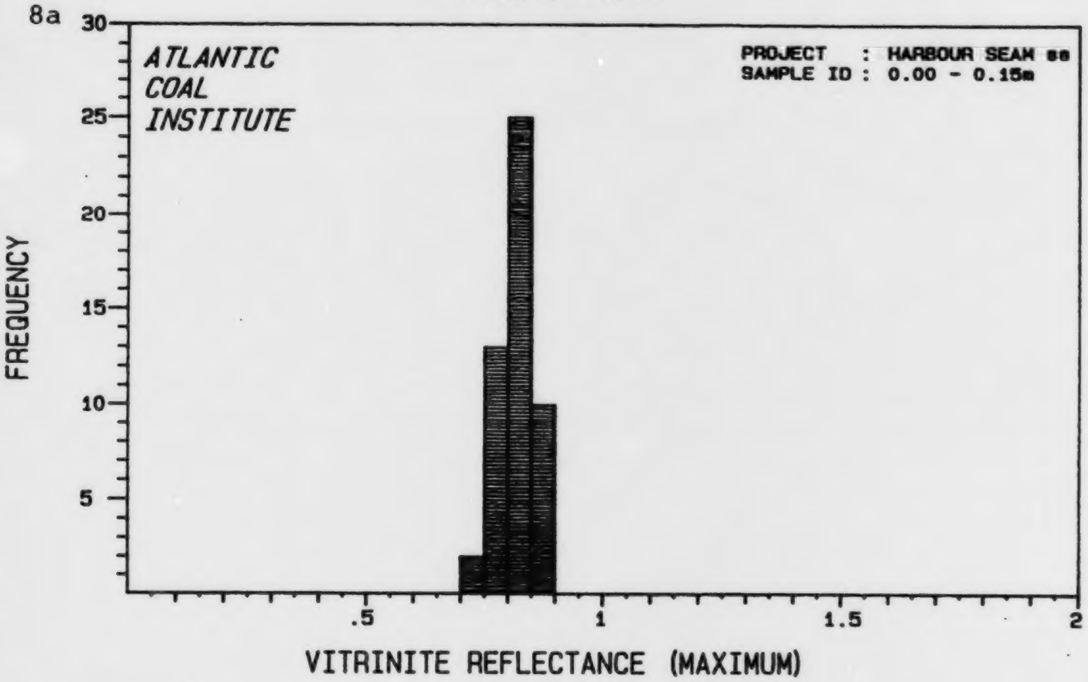
0.96	0.96	0.97	0.97	0.97	0.98	0.98	0.99	0.99	1.00	1.00
1.01	1.01	1.01	1.01	1.02	1.02	1.02	1.02	1.02	1.02	1.03
1.03	1.03	1.03	1.03	1.03	1.04	1.04	1.04	1.04	1.04	1.04
1.05	1.05	1.05	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.07
1.07	1.07	1.07	1.08	1.08	1.13					

POPULATION 1 RANGES FROM .95 TO 1.149
MEAN = 1.03
STANDARD DEVIATION = .036
NUMBER OF POINTS = 50

POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.81	.035	50

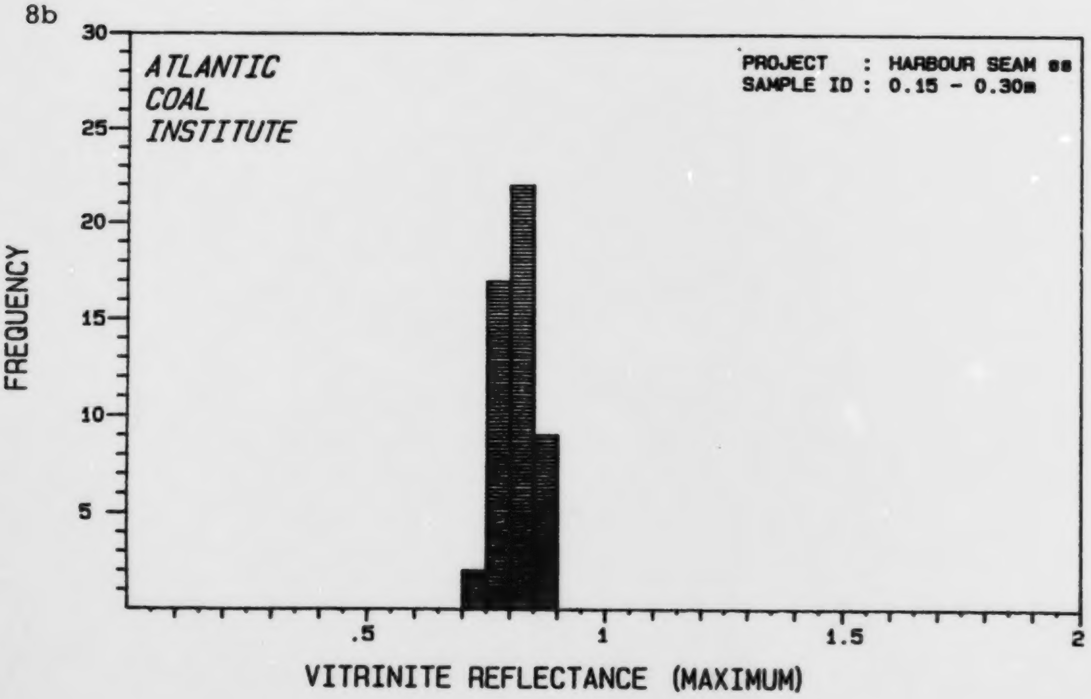
FIGURE III.8

8a



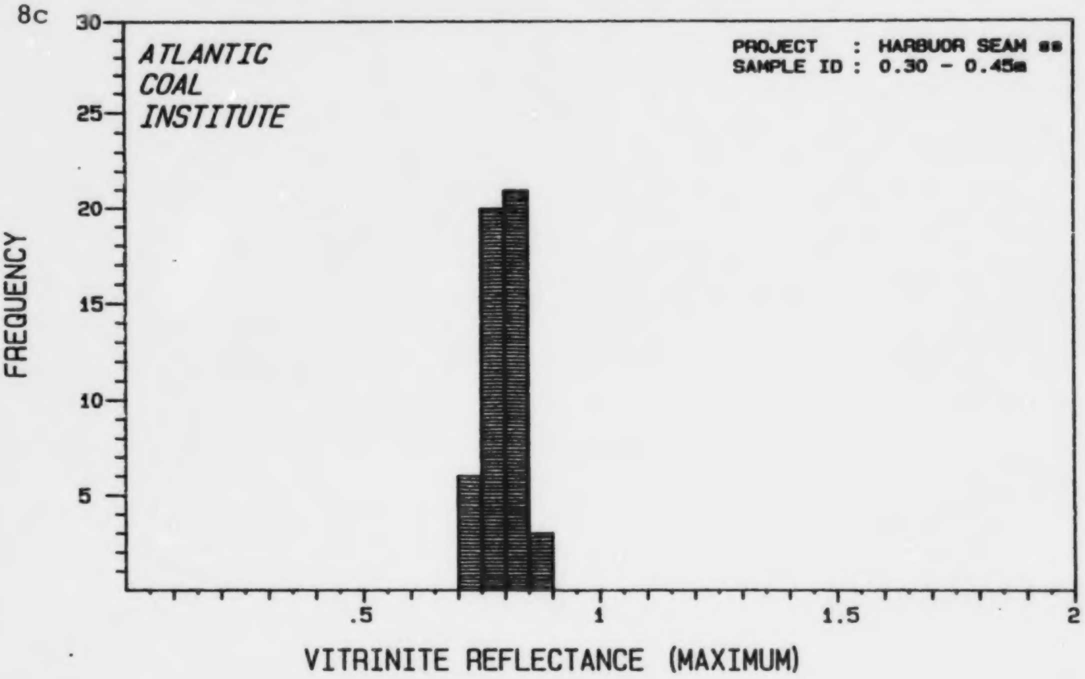
POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.81	.040	50

8b



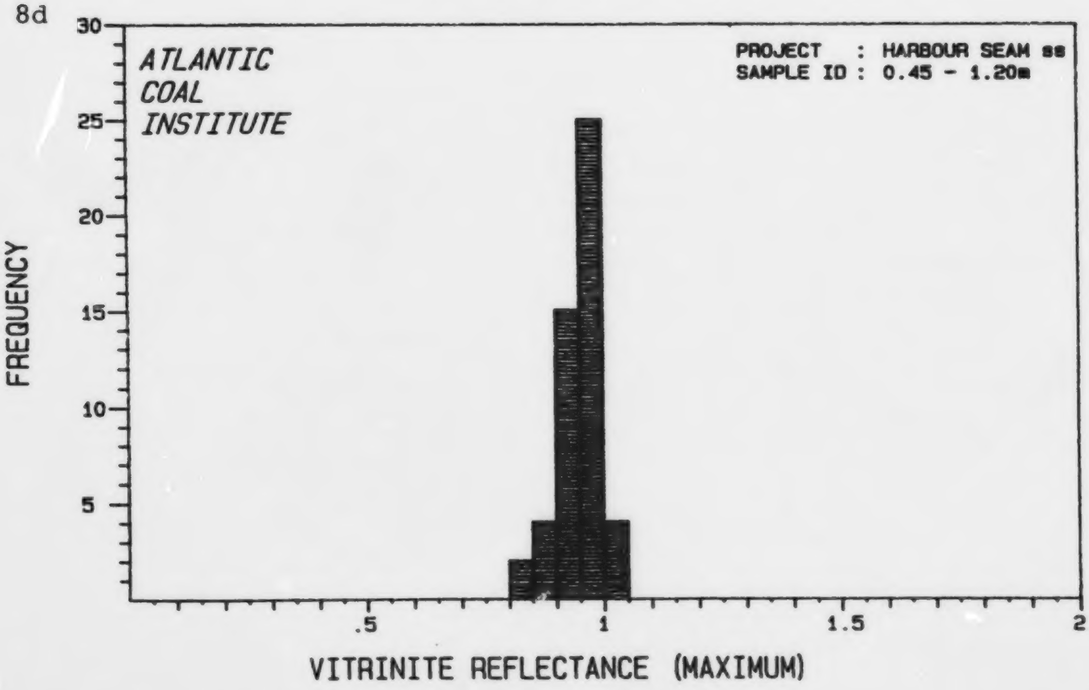
POPULATION	MEAN	STANDARD DEVIATION	# OF POINTS
▤ 1	.79	.036	50

8c



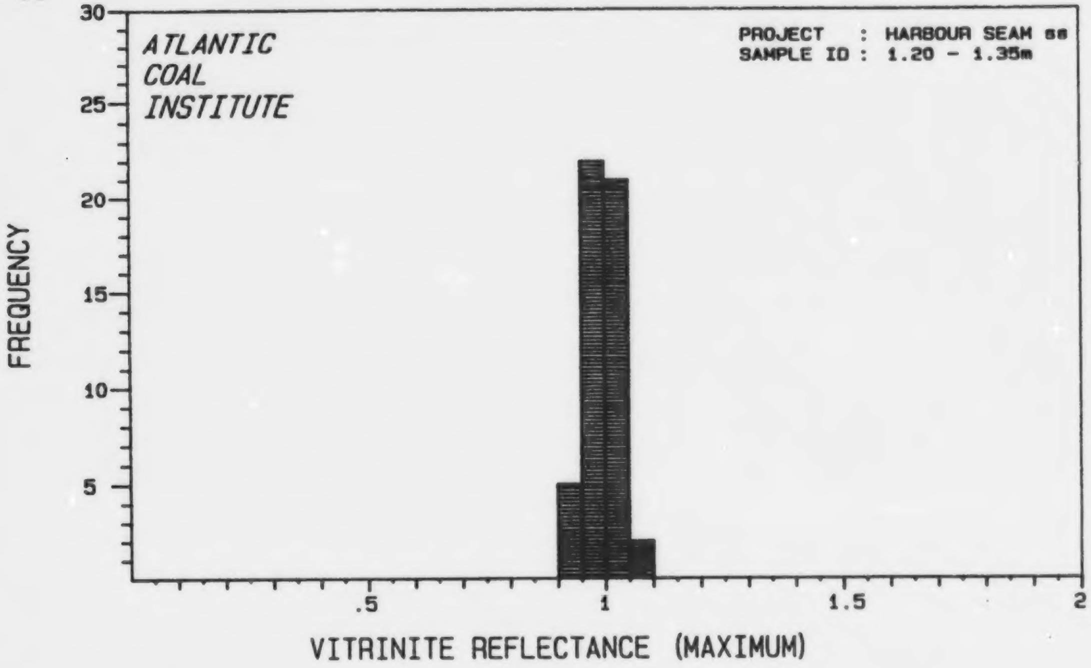
POPULATION	MEAN	STANDARD DEVIATION	# OF POINTS
▤ 1	.94	.045	50

8d



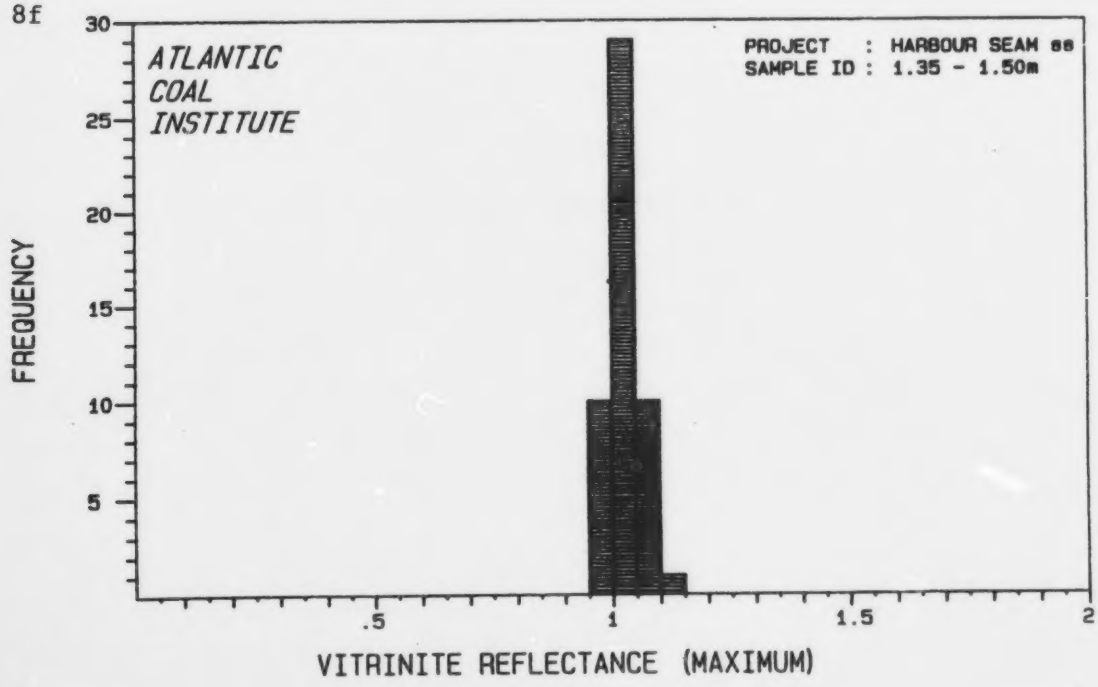
POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.99	.034	50

8e



POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	1.02	.031	50

8f



POPULATION	MEAN	STANDARD DEVIATION	# OF POINTS
▤ 1	1.03	.036	50

8g

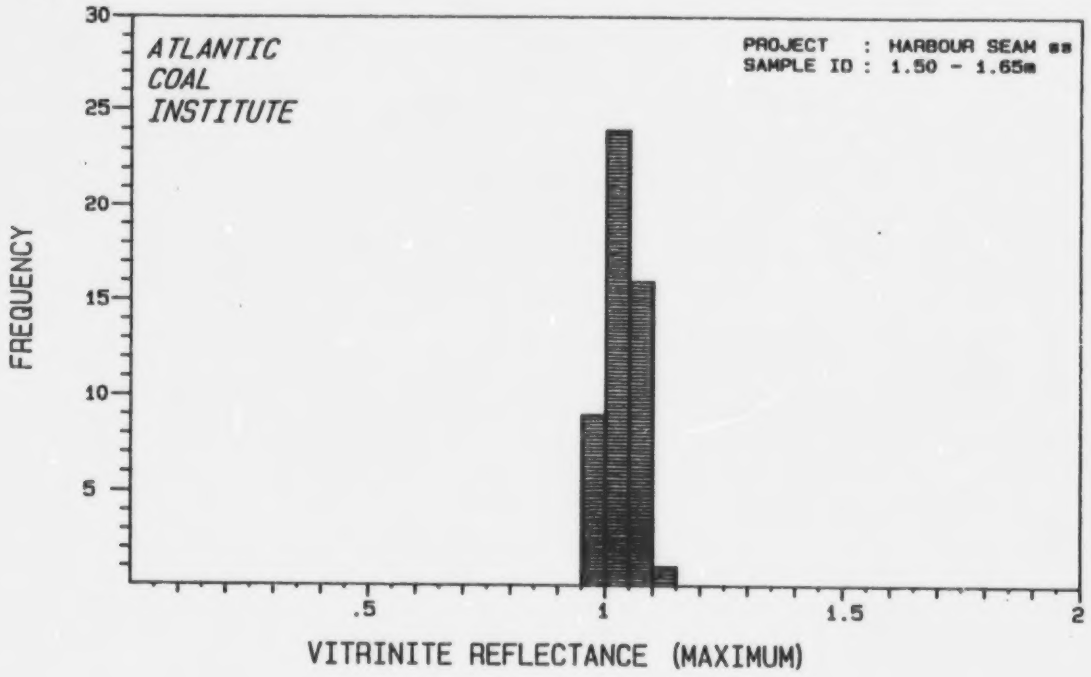


TABLE III.35

Vitrinite Reflectance Data Points

Phalen Seam - Shale Roof

```
0.00 - 0.15m

 0.80   0.82   0.83   0.83   0.84   0.84   0.84   0.85   0.86   0.87   0.87
 0.87   0.88   0.88   0.88   0.88   0.88   0.88   0.89   0.89   0.89   0.89
 0.89   0.89   0.89   0.89   0.89   0.90   0.90   0.90   0.90   0.90   0.91
 0.91   0.91   0.91   0.91   0.92   0.92   0.93   0.93   0.93   0.93   0.93
 0.93   0.93   0.93   0.93   0.94   0.95

POPULATION 1 RANGES FROM .8 TO .999
MEAN = .89
STANDARD DEVIATION = .034
NUMBER OF POINTS = 50


0.15 - 0.30m

 0.79   0.81   0.83   0.85   0.86   0.87   0.88   0.89   0.89   0.89   0.90
 0.90   0.90   0.90   0.90   0.90   0.91   0.91   0.91   0.91   0.91   0.92
 0.92   0.92   0.92   0.92   0.92   0.93   0.93   0.93   0.93   0.93   0.93
 0.93   0.93   0.94   0.94   0.94   0.94   0.94   0.94   0.95   0.96   0.96
 0.96   0.97   0.97   0.97   0.98   1.00

POPULATION 1 RANGES FROM .75 TO 1.049
MEAN = .92
STANDARD DEVIATION = .041
NUMBER OF POINTS = 50


0.30 - 0.45m

 0.85   0.86   0.88   0.90   0.91   0.92   0.92   0.93   0.93   0.93   0.93
 0.94   0.94   0.94   0.94   0.94   0.95   0.95   0.95   0.95   0.95   0.95
 0.95   0.95   0.96   0.96   0.96   0.96   0.96   0.96   0.96   0.97   0.97
 0.97   0.98   0.98   0.98   0.98   0.98   0.98   0.99   0.99   1.00   1.00
 1.00   1.01   1.02   1.02   1.04   1.06

POPULATION 1 RANGES FROM .85 TO 1.099
MEAN = .96
STANDARD DEVIATION = .04
NUMBER OF POINTS = 50


0.45 - 0.93m

 0.82   0.87   0.87   0.88   0.89   0.89   0.90   0.90   0.90   0.90   0.90
 0.91   0.91   0.92   0.92   0.92   0.92   0.92   0.92   0.93   0.93   0.93
 0.93   0.93   0.93   0.93   0.93   0.94   0.94   0.95   0.95   0.95   0.96
 0.96   0.96   0.96   0.96   0.96   0.96   0.96   0.97   0.97   0.97   0.98
 0.98   0.98   0.98   0.99   0.99   1.01

POPULATION 1 RANGES FROM .8 TO 1.049
MEAN = .93
STANDARD DEVIATION = .037
NUMBER OF POINTS = 50
```

TABLE III.35

Vitrinite Reflectance Data Points

Phalen Seam - Shale Roof

```
0.93 - 2.13m

 0.86   0.88   0.89   0.91   0.91   0.91   0.92   0.92   0.93   0.93   0.93
 0.94   0.94   0.94   0.94   0.94   0.94   0.95   0.95   0.95   0.95   0.95
 0.95   0.96   0.96   0.96   0.96   0.96   0.96   0.96   0.96   0.97   0.97
 0.97   0.98   0.98   0.99   0.99   0.99   1.00   1.00   1.01   1.01   1.01
 1.01   1.01   1.01   1.01   1.02   1.03

POPULATION 1 RANGES FROM .85 TO 1.049
MEAN = .96
STANDARD DEVIATION = .038
NUMBER OF POINTS = 50
```

```
2.13 - 2.28m

 0.82   0.85   0.86   0.86   0.87   0.87   0.87   0.87   0.88   0.88   0.89
 0.89   0.89   0.89   0.89   0.89   0.90   0.90   0.90   0.91   0.91   0.91
 0.91   0.92   0.92   0.92   0.92   0.92   0.92   0.92   0.93   0.93   0.93
 0.93   0.93   0.93   0.94   0.94   0.94   0.94   0.94   0.94   0.94   0.94
 0.94   0.94   0.95   0.95   0.95   0.96

POPULATION 1 RANGES FROM .8 TO .999
MEAN = .9099999
STANDARD DEVIATION = .031
NUMBER OF POINTS = 50
```

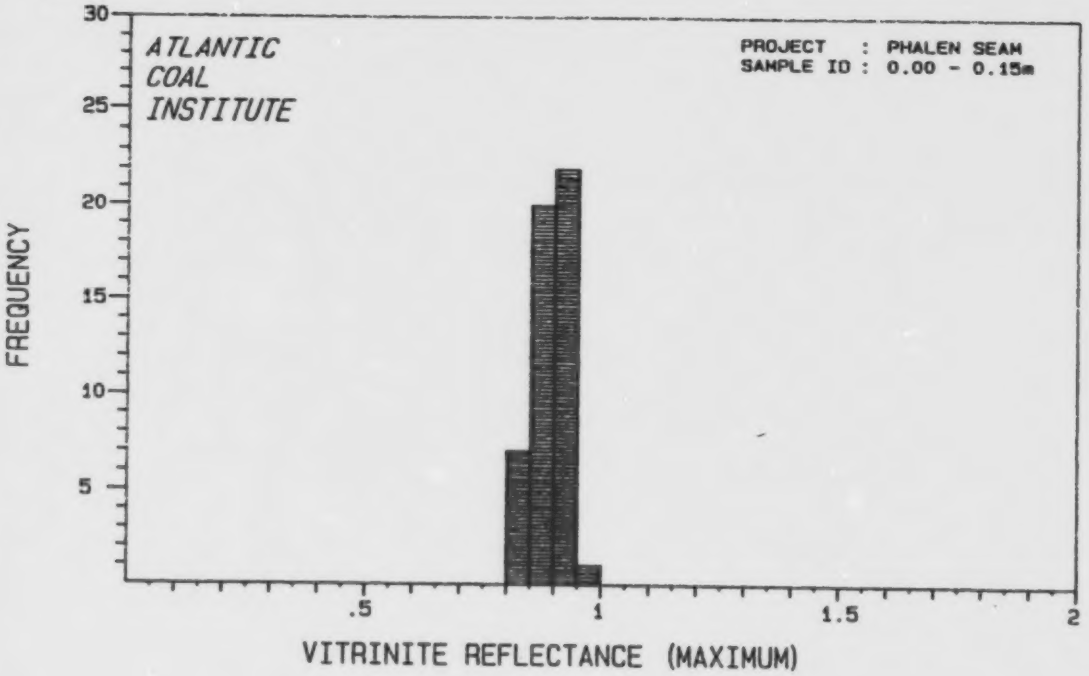
```
2.28 - 2.48m

 0.85   0.86   0.86   0.87   0.88   0.88   0.88   0.88   0.88   0.88   0.88
 0.89   0.89   0.90   0.90   0.90   0.90   0.90   0.90   0.90   0.90   0.90
 0.90   0.90   0.90   0.91   0.91   0.91   0.91   0.91   0.91   0.92   0.92
 0.92   0.92   0.93   0.93   0.93   0.93   0.93   0.94   0.94   0.94   0.95
 0.95   0.95   0.95   0.96   0.96   0.96

POPULATION 1 RANGES FROM .85 TO .999
MEAN = .9099999
STANDARD DEVIATION = .028
NUMBER OF POINTS = 50
```

```
2.53 - 2.73m

 0.81   0.83   0.83   0.84   0.85   0.87   0.87   0.87   0.88   0.88   0.88
 0.88   0.88   0.88   0.89   0.89   0.89   0.90   0.90   0.90   0.90   0.90
 0.91   0.91   0.91   0.91   0.91   0.92   0.92   0.92   0.92   0.92   0.92
 0.92   0.93   0.93   0.93   0.93   0.94   0.94   0.94   0.94   0.94   0.94
 0.94   0.95   0.95   0.96   0.98   0.99

POPULATION 1 RANGES FROM .8 TO .999
MEAN = .9099999
STANDARD DEVIATION = .037
NUMBER OF POINTS = 50
```

POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.89	.034	50

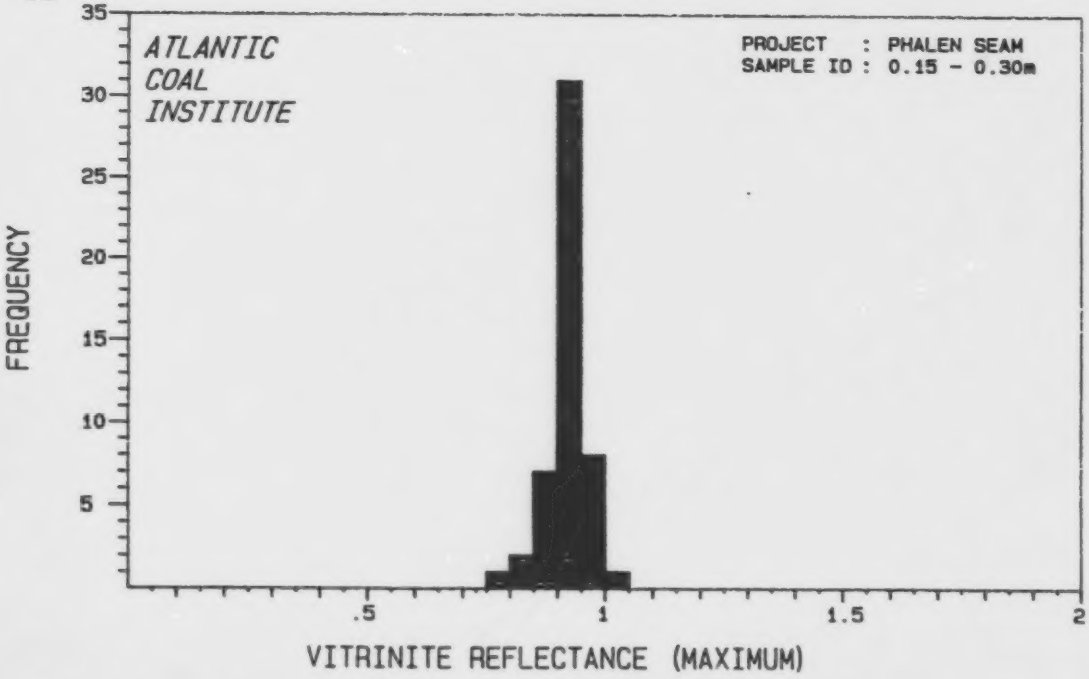
FIGURE III.9

9a



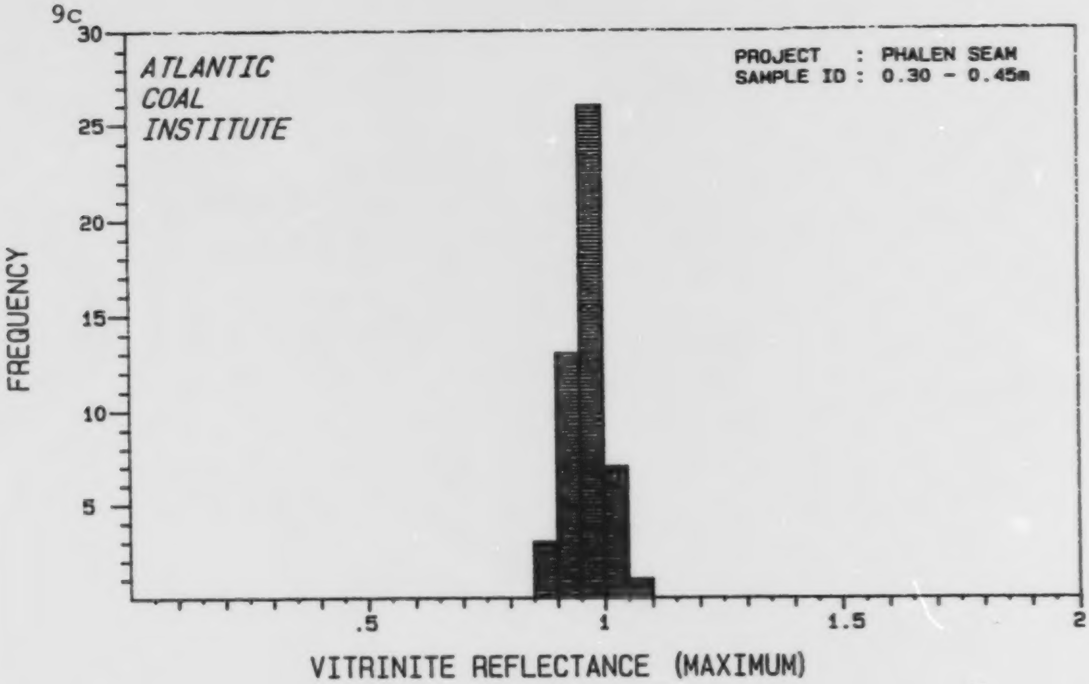
POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.92	.041	50

9b



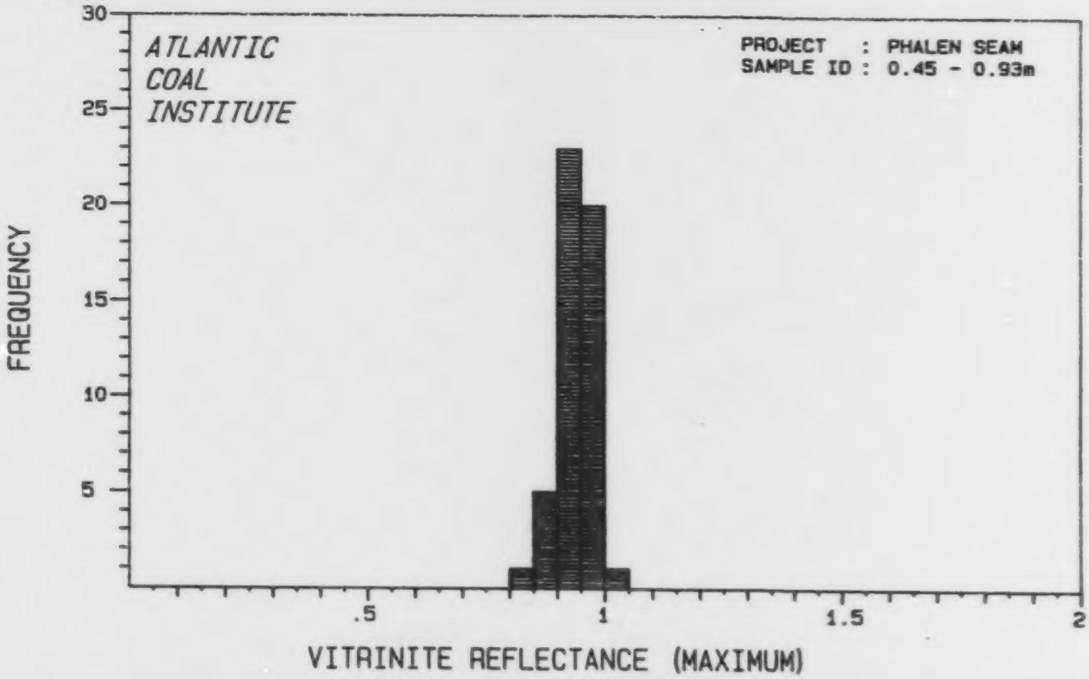
POPULATION	MEAN	STANDARD DEVIATION	# OF POINTS
▤ 1	.96	.040	50

9c



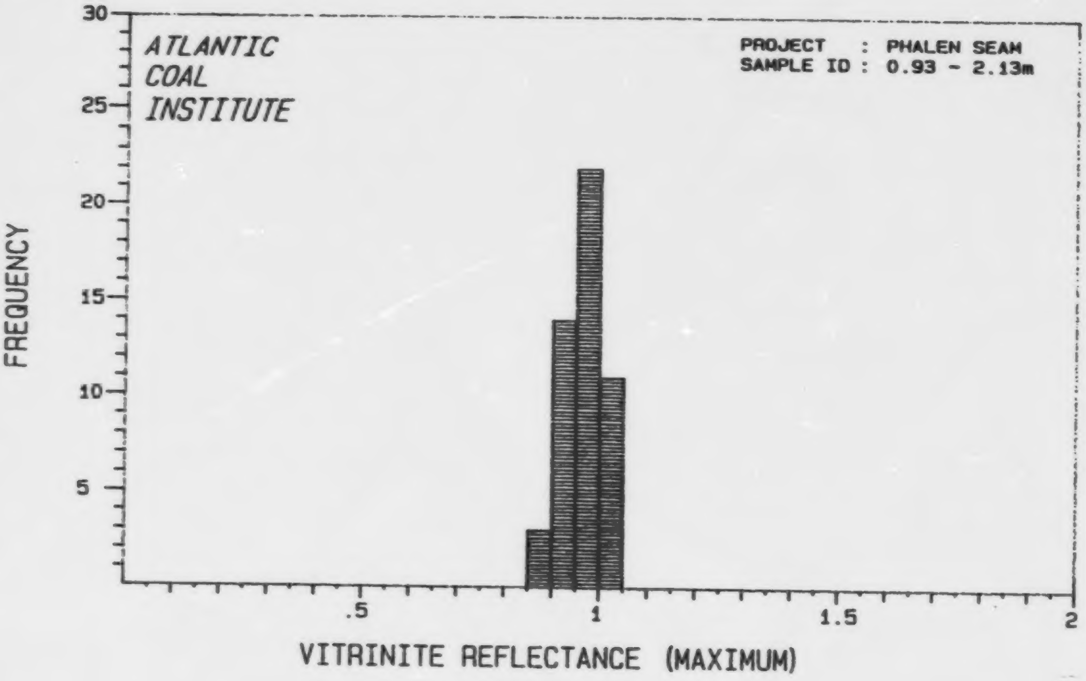
POPULATION	MEAN	STANDARD DEVIATION	# OF POINTS
▤ 1	.93	.037	50

9d



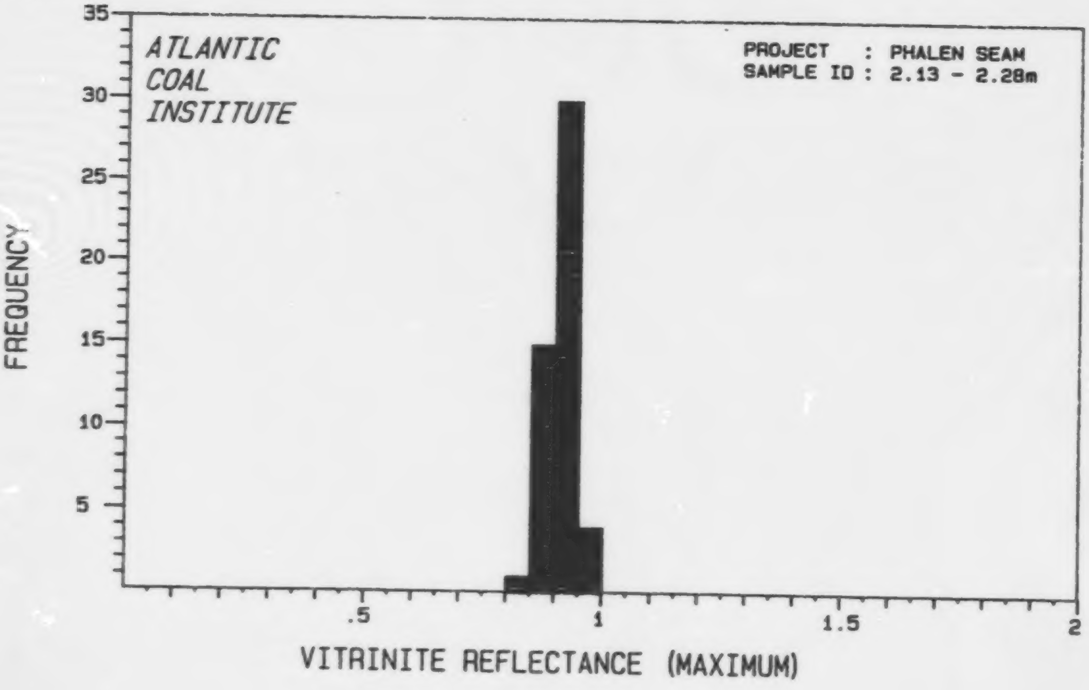
POPULATION	MEAN	STANDARD DEVIATION	# OF POINTS
▤ 1	.96	.038	50

9e



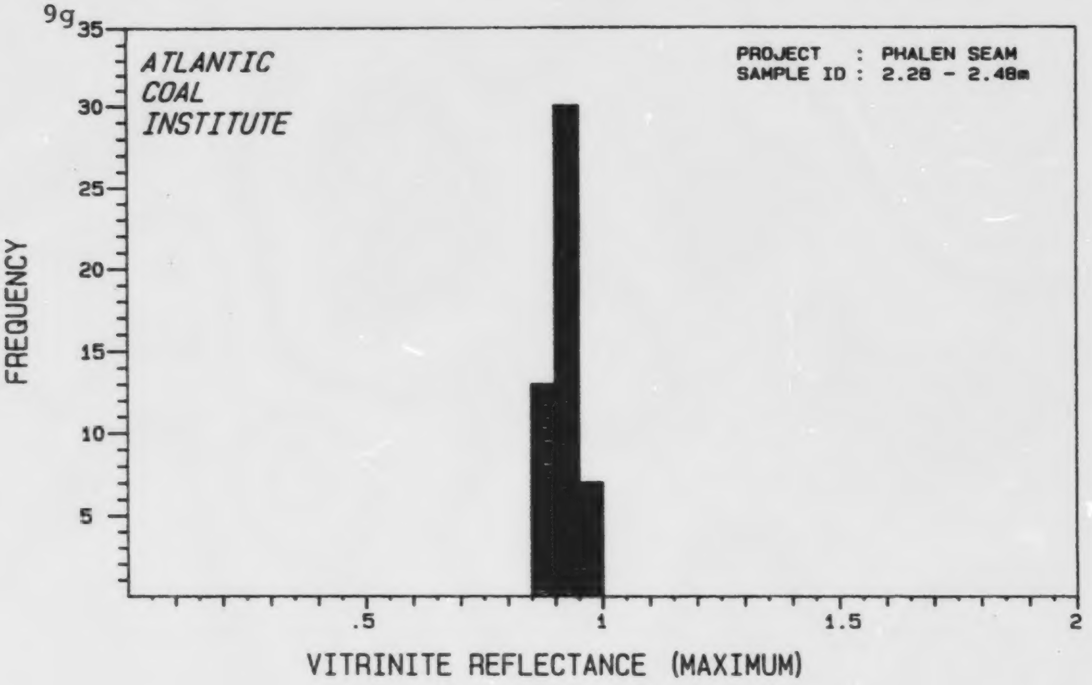
POPULATION	MEAN	STANDARD DEVIATION	# OF POINTS
▤ 1	.91	.031	50

9f



POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.91	.028	50

9g



POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.91	.037	50

9h

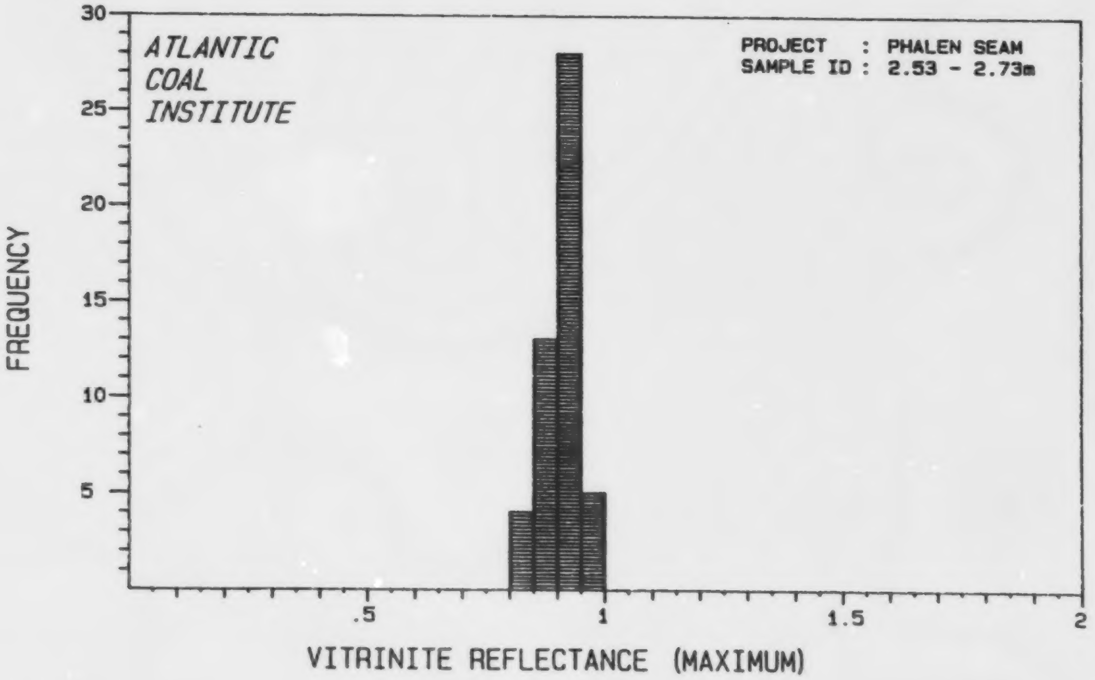


TABLE III.36

Vitrinite Reflectance Data Points

Phalen Seam - Sandstone Roof

0.00 - 0.15m

0.78	0.80	0.80	0.81	0.81	0.81	0.84	0.84	0.84	0.85	0.85
0.86	0.86	0.86	0.87	0.87	0.87	0.87	0.87	0.88	0.88	0.88
0.88	0.88	0.88	0.88	0.88	0.89	0.89	0.89	0.89	0.89	0.90
0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.91	0.91	0.92	0.93
0.93	0.93	0.93	0.94	0.94	0.95					

POPULATION 1 RANGES FROM .75 TO .999
MEAN = .88
STANDARD DEVIATION = .039
NUMBER OF POINTS = 50

0.15 - 0.30m

0.80	0.81	0.83	0.87	0.88	0.91	0.91	0.92	0.92	0.93	0.93
0.93	0.93	0.93	0.93	0.93	0.94	0.94	0.95	0.95	0.95	0.95
0.95	0.95	0.95	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.97
0.97	0.98	0.98	0.98	0.98	0.98	0.99	0.99	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.01	1.01					

POPULATION 1 RANGES FROM .8 TO 1.049
MEAN = .95
STANDARD DEVIATION = .047
NUMBER OF POINTS = 50

0.30 - 0.45m

0.91	0.91	0.92	0.92	0.92	0.93	0.93	0.94	0.94	0.94	0.94
0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.96	0.96	0.96
0.96	0.96	0.96	0.96	0.96	0.97	0.97	0.97	0.97	0.97	0.97
0.97	0.97	0.98	0.98	0.98	0.98	0.98	0.98	0.99	0.99	0.99
1.00	1.02	1.02	1.02	1.02	1.06					

POPULATION 1 RANGES FROM .9 TO 1.099
MEAN = .96
STANDARD DEVIATION = .031
NUMBER OF POINTS = 50

0.45 - 1.35m

0.88	0.91	0.92	0.92	0.92	0.92	0.92	0.93	0.93	0.93	0.93
0.93	0.94	0.94	0.94	0.94	0.94	0.94	0.95	0.95	0.95	0.96
0.96	0.96	0.96	0.97	0.97	0.97	0.97	0.98	0.98	0.98	0.98
0.98	0.98	0.98	0.98	0.99	0.99	0.99	0.99	1.00	1.00	1.00
1.00	1.01	1.01	1.02	1.03	1.07					

POPULATION 1 RANGES FROM .85 TO 1.099
MEAN = .96
STANDARD DEVIATION = .036
NUMBER OF POINTS = 50

TABLE III.36

Vitrinite Reflectance Data Points

Phalen Seam - Sandstone Roof

```
1.35 - 1.45m

 0.87   0.88   0.88   0.90   0.91   0.91   0.92   0.92   0.92   0.92   0.92
 0.93   0.93   0.93   0.93   0.93   0.93   0.94   0.94   0.94   0.94   0.94
 0.94   0.94   0.94   0.95   0.95   0.95   0.95   0.96   0.96   0.96   0.96
 0.96   0.97   0.97   0.97   0.97   0.97   0.97   0.97   0.98   0.98   0.98
 0.98   0.98   0.99   1.00   1.00   1.00

POPULATION 1 RANGES FROM .85 TO 1.049
MEAN = .95
STANDARD DEVIATION = .031
NUMBER OF POINTS = 50
```

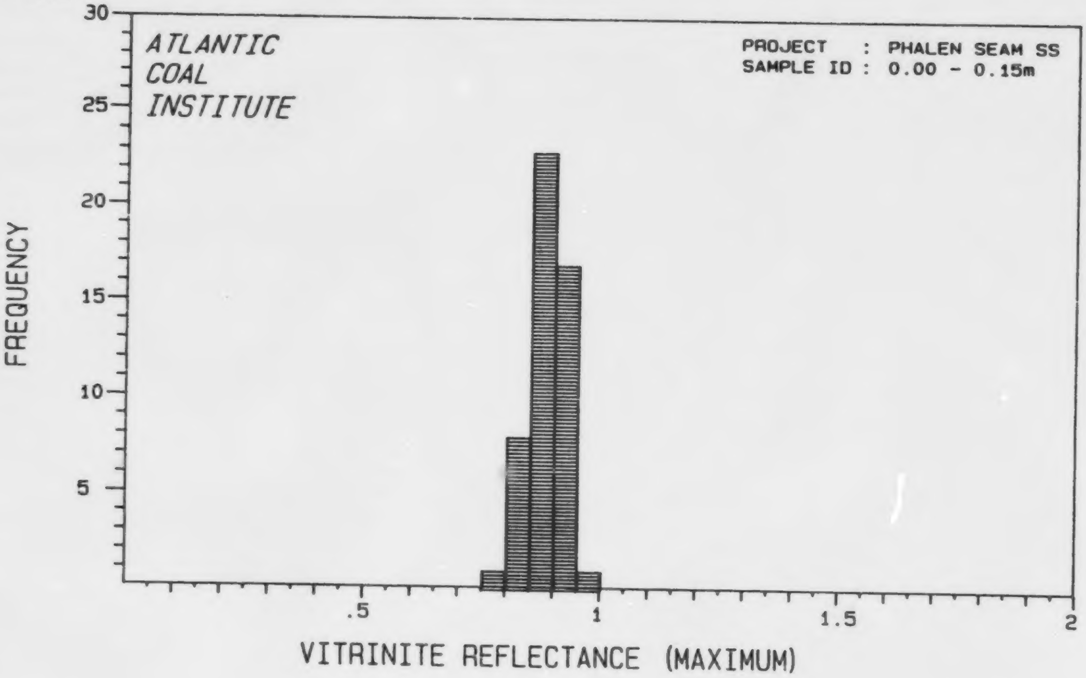
```
1.50 - 1.65m

 0.89   0.90   0.90   0.91   0.91   0.93   0.93   0.93   0.94   0.94   0.94
 0.94   0.94   0.94   0.94   0.95   0.95   0.95   0.95   0.95   0.95   0.95
 0.95   0.95   0.96   0.96   0.96   0.96   0.96   0.96   0.96   0.96   0.96
 0.97   0.97   0.97   0.97   0.97   0.98   0.98   0.98   0.99   0.99   0.99
 0.99   1.00   1.00   1.00   1.01   1.01

POPULATION 1 RANGES FROM .85 TO 1.049
MEAN = .96
STANDARD DEVIATION = .028
NUMBER OF POINTS = 50
```

```
1.65 - 1.98m

 0.87   0.89   0.89   0.90   0.90   0.90   0.92   0.92   0.92   0.92   0.92
 0.92   0.93   0.93   0.93   0.94   0.94   0.94   0.94   0.94   0.95   0.95
 0.95   0.95   0.95   0.95   0.95   0.96   0.96   0.96   0.96   0.96   0.96
 0.96   0.96   0.97   0.97   0.97   0.97   0.97   0.97   0.97   0.98   0.98
 0.98   0.99   1.00   1.00   1.00   1.01

POPULATION 1 RANGES FROM .85 TO 1.049
MEAN = .95
STANDARD DEVIATION = .031
NUMBER OF POINTS = 50
```

POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.88	.039	50

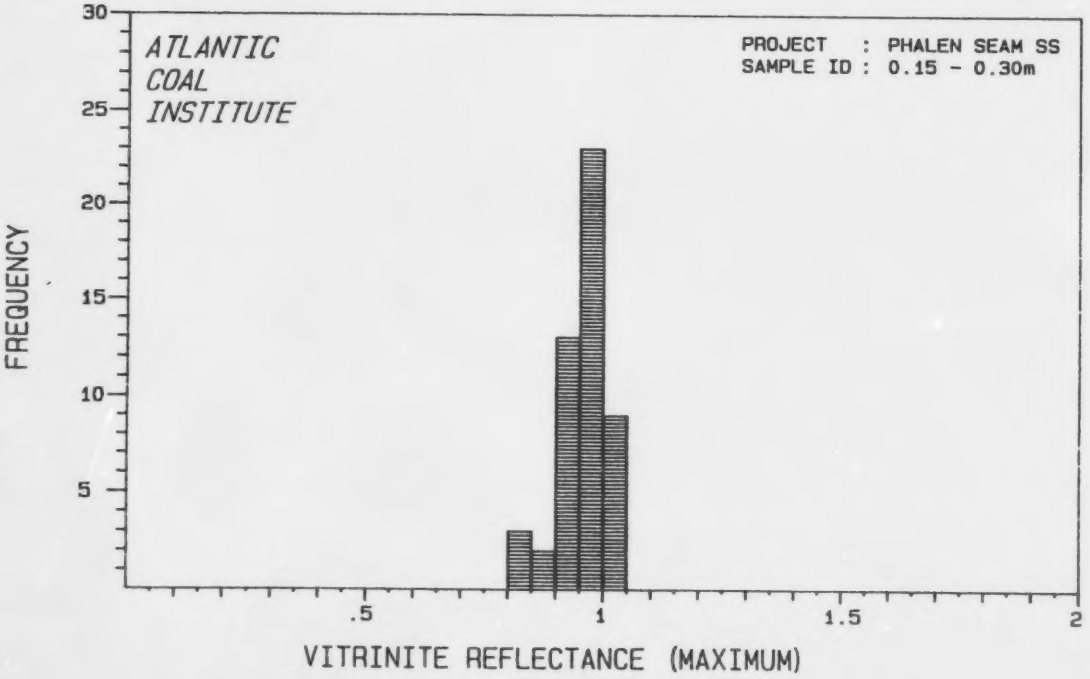
FIGURE III.10

10a



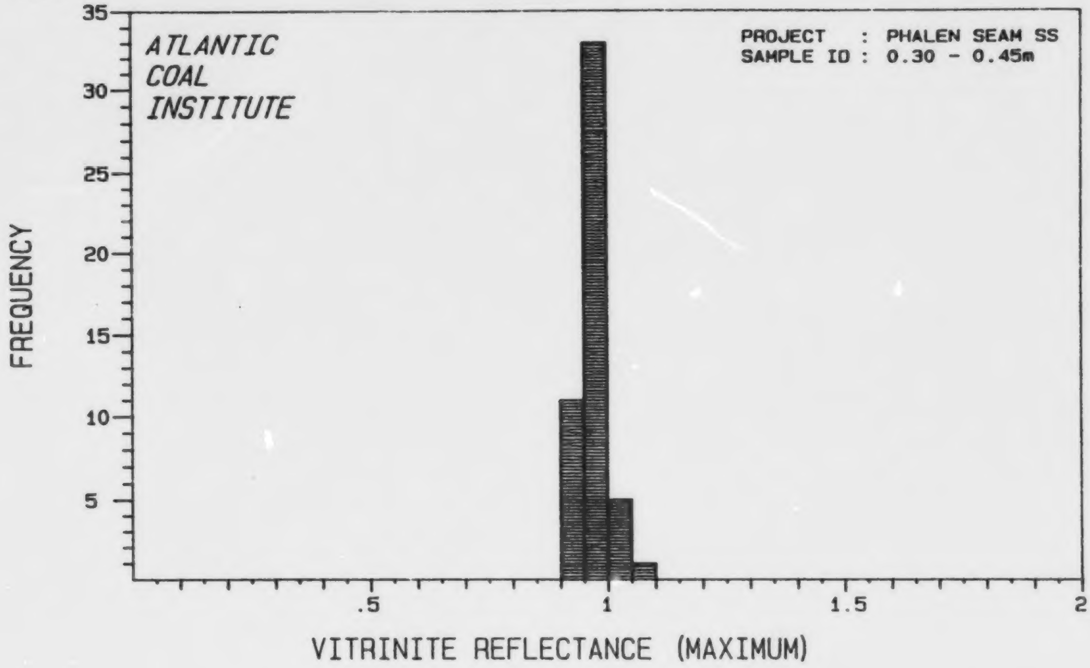
POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.95	.047	50

10b



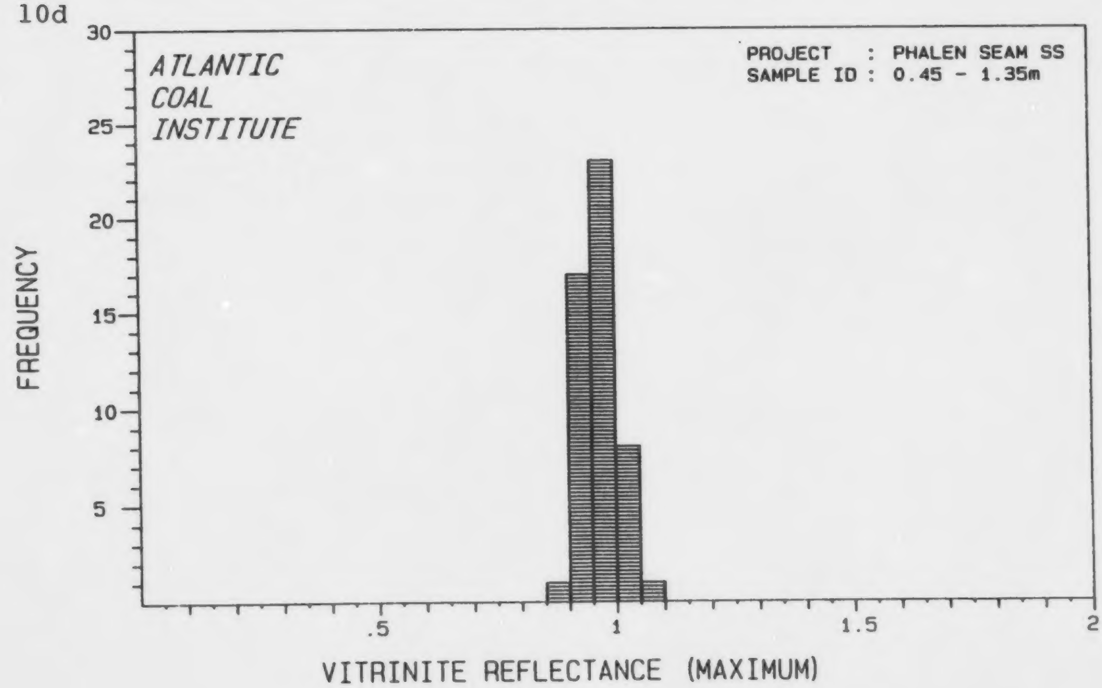
POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.96	.031	50

10c



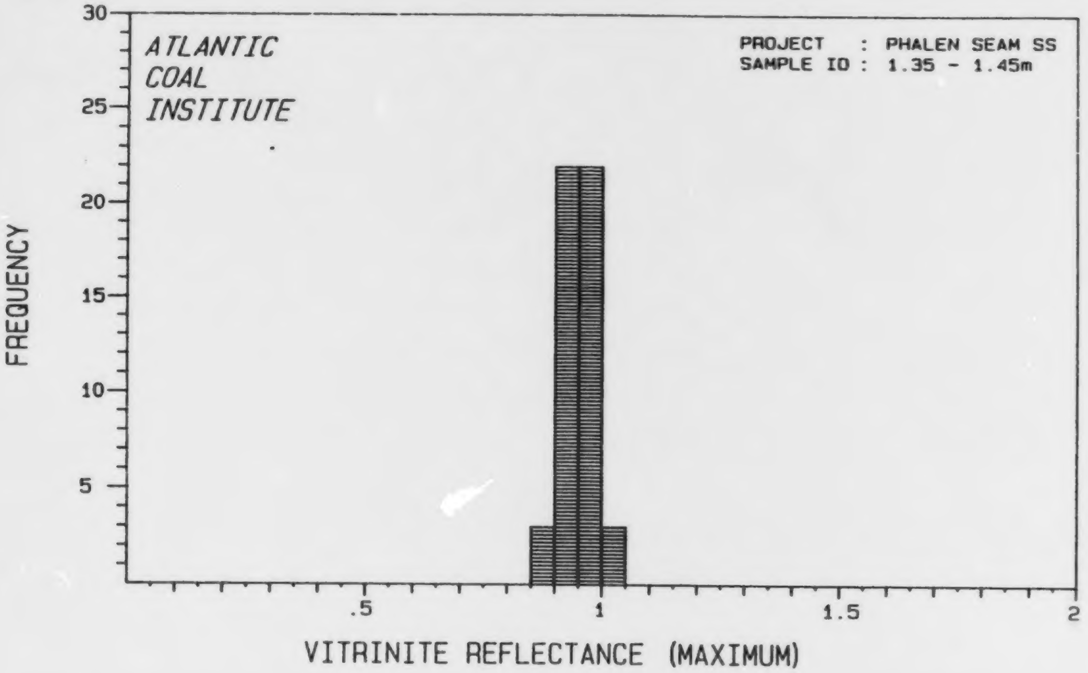
POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.96	.036	50

10d



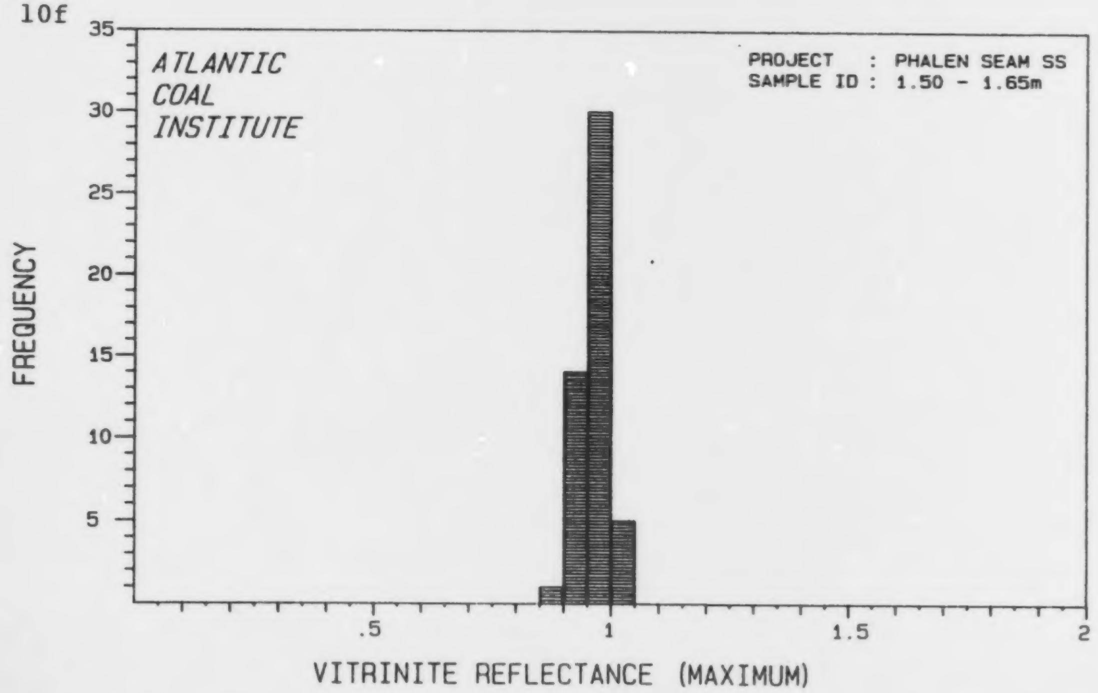
POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.95	.031	50

10e



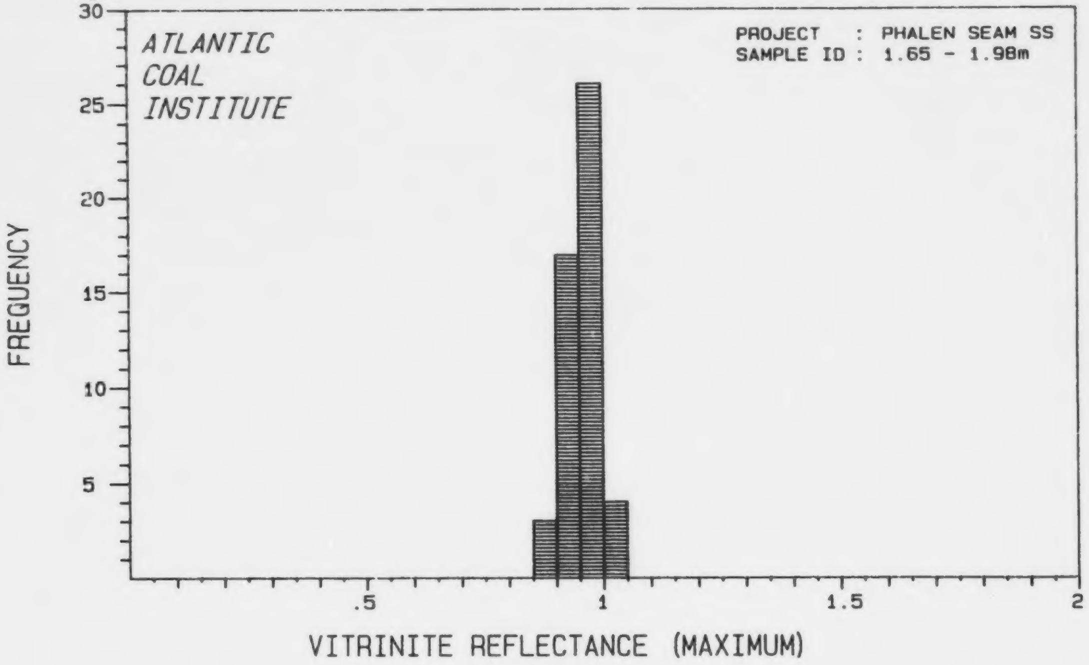
POPULATION		MEAN	STANDARD DEVIATION	# OF POINTS
▤	1	.96	.028	50

10f



POPULATION	MEAN	STANDARD DEVIATION	# OF POINTS
▤ 1	.95	.031	50

10g



APPENDIX III

C. Scanning Electron Microscopy

i) Summary Tables

APPENDIX III C. Scanning Electron Microscopy

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FIGURE III.13 C.M.A. Results - Phalen Seam, shale roof, sandstone roof

TABLE III.37 **S.E.M.-C.M.A. seam averages of selected coal seams - Sydney Basin**

SEAM	ROOF ROCK	PYRITE wt%	OTH. "S" wt%	QUARTZ wt%	KAOLIN. wt%	ILLITE wt%	OTH. CLAYS wt%	MIXSIL. wt%	SIDERITE wt%	CAL/DOL/GY. wt%	HALITE wt%	APATITE wt%	RUTILE wt%	NOT-INT. wt%	UNKNOWN wt%
Hub Seam	Shale	52.6	9.2	3.2	9.0	3.4	0.1	11.4	0.4	0.2	0.0	0.0	0.0	9.5	0.8
Prince Mine	Sandstone	69.8	11.7	0.7	4.9	2.2	0.1	5.2	0.7	0.5	0.2	0.0	0.0	3.3	0.7
Harbour Seam	Shale	30.4	6.1	6.5	7.9	2.2	8.1	16.9	2.3	0.3	0.4	0.9	0.05	13.2	4.8
Lingan Mine	Sandstone	70.5	6.9	2.9	8.5	1.4	0.2	5.8	0.1	0.5	0.3	0.1	0.0	2.3	0.4
Phalen Seam	Shale	25.9	4.8	6.0	8.3	5.3	0.5	12.7	0.0	12.1	0.6	0.1	0.0	20.5	3.4
Phalen Colliery	Sandstone	44.2	7.6	5.9	7.0	6.0	0.2	10.4	0.2	4.1	0.3	0.2	0.6	9.5	3.8

OTH. "S" includes FE-SUL, PYJAR, JAROSITE, MIXSUL, ORGSUL,QUARPYR.

OTH. CLAYS includes MONTMOR, CHAMOSITE.

MIXSIL includes QUARORG, MIXSIL.

CAL/DOL/GY includes CALCITE, DOLOMITE, GYPSUM, ANKERITE.

HALITE includes HALITE, UNKCHLOR

TABLE III.38 **S.E.M.-C.M.A. analysis of selected coal seams - Sydney Basin**

SEAM	INTERVAL (METERS)	PYRITE wt%	OTH. "S" wt%	QUARTZ wt%	KAOLIN. wt%	ILLITE wt%	OTH. CLAYS wt%	MIXSIL. wt%	SIDERITE wt%	CAL/DOL/GY. wt%	HALITE wt%	APATITE wt%	RUTILE wt%	NOT-INT. wt%	UNKNOWN wt%
Hub Seam/	Roof														
Prince Mine:															
Shale	0.00 - 0.08	47.8	8.3	2.0	7.2	4.9	0.1	9.6	0.7	0.0	0.0	0.0	0.0	18.2	1.1
Roof	0.08 - 0.23	16.8	5.0	8.1	21.9	7.3	0.4	30.4	0.0	0.1	0.0	0.0	0.2	6.7	3.1
	0.23 - 0.38	66.6	10.3	1.3	8.3	0.7	0.0	9.0	0.0	0.0	0.0	0.0	0.0	2.9	0.8
	0.38 - 1.28*	33.9	12.2	1.1	15.5	3.6	0.0	15.8	0.7	0.1	0.1	0.0	0.0	16.7	0.4
	1.28 - 2.03*	73.8	5.3	5.6	2.0	1.3	0.1	5.3	0.1	0.5	0.0	0.0	0.0	5.0	1.0
	2.03 - 2.18	68.0	9.4	1.9	4.2	6.1	0.4	6.9	0.1	0.0	0.0	0.0	0.0	2.9	0.1
	2.18 - 2.33	56.7	10.9	4.3	3.9	9.0	0.5	8.5	0.4	0.1	0.0	0.0	0.0	4.5	1.1
	2.33 - 2.43	69.0	13.6	1.8	1.5	2.0	0.0	4.8	2.1	0.0	0.0	0.0	0.0	4.2	1.0
	Floor														
	Average'	52.6	9.2	3.2	9.0	3.4	0.1	11.4	0.4	0.2	0.0	0.0	0.0	9.5	0.8
Hub Seam/	Roof														
Prince Mine:															
Sandstone	0.00 - 0.15	69.5	18.8	1.1	3.2	0.5	0.0	2.7	0.0	0.7	0.6	0.0	0.0	2.5	0.4
Roof	0.15 - 0.30	67.9	6.2	0.4	9.0	1.8	0.2	7.5	0.0	0.0	0.5	0.0	0.0	5.3	1.1
	0.30 - 0.45	58.5	12.2	0.8	12.5	2.5	0.2	8.3	0.0	0.2	0.0	0.0	0.0	4.0	0.7
	0.45 - 1.52*	71.6	12.3	0.1	3.1	2.3	0.0	4.7	1.2	0.5	0.0	0.0	0.0	3.5	0.7
	Parting 0.01														
	1.53 - 1.68	77.3	9.5	1.1	3.7	1.5	0.0	3.7	0.0	0.0	0.0	0.0	0.0	2.5	0.6
	1.68 - 1.83	79.6	9.1	0.7	1.8	1.0	0.1	2.0	0.7	2.1	0.0	0.0	0.0	1.8	1.1
	1.83 - 1.98	53.0	10.3	4.0	12.4	5.5	0.6	10.8	0.0	0.3	1.3	0.0	0.0	1.7	0.2
	Floor														
	Average'	69.8	11.7	0.7	4.9	2.2	0.1	5.2	0.7	0.5	0.2	0.0	0.0	3.3	0.7

TABLE III.39 **S.E.M.-C.M.A. analysis of selected coal seams - Sydney Basin**

SEAM	INTERVAL (METERS)	PYRITE wt%	OTH. "S" wt%	QUARTZ wt%	KAOLIN. wt%	ILLITE wt%	OTH. CLAYS wt%	MIXSIL. wt%	SIDERITE wt%	CAL/DOL/GY. wt%	HALITE wt%	APATITE wt%	RUTILE wt%	NOT-INT. wt%	UNKNOWN wt%
Harbour Seam/	Roof														
Lingan Mine:															
Shale	0.00 - 0.15	34.4	10.1	1.8	13.6	1.0	0.0	10.0	0.0	0.0	0.0	11.0	0.0	13.8	4.2
Roof	0.15 - 0.30	62.2	11.1	2.1	12.8	0.5	0.0	8.1	0.1	0.0	0.0	0.0	0.0	2.4	0.5
	0.30 - 0.45	51.9	6.8	1.3	18.9	1.2	0.2	11.8	0.2	0.2	0.0	0.0	0.0	5.0	2.5
	0.45 - 1.35*	17.8	4.8	9.7	2.6	0.8	15.9	22.3	0.9	0.1	0.7	0.0	0.1	16.8	7.7
	1.35 - 1.50	8.2	3.3	6.7	13.3	4.3	0.6	15.5	21.1	2.0	0.0	0.0	0.0	21.2	4.0
	1.50 - 1.65	57.9	6.8	4.4	13.4	1.8	0.5	9.2	0.3	0.6	0.0	0.0	0.0	4.7	0.4
	1.65 - 1.80	43.5	6.1	3.3	7.7	13.0	0.0	14.7	0.0	0.8	0.0	0.0	0.0	10.8	0.1
	Floor														
	Average'	30.4	6.1	6.5	7.9	2.2	8.1	16.9	2.3	0.3	0.4	0.9	0.05	13.2	4.8
Harbour Seam/	Roof														
Lingan Mine:															
Sandstone	0.00 - 0.15	68.4	8.3	3.6	7.3	1.9	0.1	5.8	0.3	0.5	0.2	1.5	0.0	1.0	1.0
Roof	0.15 - 0.30	92.0	3.4	0.1	1.8	0.1	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.9	0.0
	0.30 - 0.45	82.8	4.6	0.8	5.3	0.2	0.0	3.8	0.0	0.7	0.0	0.0	0.0	1.4	0.5
	0.45 - 1.20*	67.0	6.9	3.0	11.6	1.4	0.3	6.9	0.0	0.5	0.6	0.0	0.0	1.6	0.2
	1.20 - 1.35	73.9	9.4	0.0	8.2	0.9	0.0	5.3	0.0	0.1	0.2	0.0	0.0	1.1	0.8
	1.35 - 1.50	71.8	8.7	0.1	5.1	0.6	0.0	3.8	1.3	0.0	0.1	0.0	0.0	7.4	1.0
	1.50 - 1.65	52.1	6.8	11.8	7.7	4.5	0.4	8.5	0.0	1.4	0.0	0.0	0.1	6.0	0.5
	Average'	70.5	6.9	2.9	8.5	1.4	0.2	5.8	0.1	0.5	0.3	0.1	0.0	2.3	0.4

TABLE III.40 S.E.M.-C.M.A. analysis of selected coal seams - Sydney Basin

SEAM	INTERVAL (METERS)	PYRITE wt%	OTH. "S" wt%	QUARTZ wt%	KAOLIN. wt%	ILLITE wt%	OTH. CLAYS wt%	MIXSIL. wt%	SIDERITE wt%	CAL/DOL/GY. wt%	HALITE wt%	APATITE wt%	RUTILE wt%	NOT-INT. wt%	UNKNOWN wt%
Phalen Seam/	Roof														
Phalen Colliery:															
Shale	0.00 - 0.15	68.3	8.9	5.1	1.7	0.4	0.0	2.3	0.0	0.1	1.2	0.0	0.0	10.3	1.6
Roof	0.15 - 0.30	24.5	2.5	14.1	12.3	11.0	1.0	14.0	0.0	2.2	1.5	0.0	0.4	14.7	1.8
	0.30 - 0.45	4.9	1.9	12.1	14.6	12.7	1.3	22.1	0.0	14.8	0.0	0.0	0.0	13.4	2.0
	0.45 - 0.93*	8.1	4.8	4.0	10.5	12.3	1.1	12.0	0.0	3.3	0.0	0.0	0.0	41.5	2.5
	0.93 - 2.13*	11.9	2.6	6.3	8.8	3.3	0.3	16.7	0.1	21.3	0.6	0.0	0.0	23.0	5.1
	2.13 - 2.28	41.6	5.7	9.5	10.1	1.2	0.0	9.4	0.0	11.0	2.9	0.2	0.0	2.8	5.5
	2.28 - 2.48	74.9	10.9	1.6	1.9	0.5	0.0	2.7	0.0	4.7	0.0	0.3	0.0	2.4	0.3
	Parting 0.05														
	2.53 - 2.73	76.6	12.7	0.7	2.0	1.6	0.0	2.0	0.0	0.4	0.0	0.5	0.0	3.2	0.2
	Floor														
	Average'	25.9	4.8	6.0	8.3	5.3	0.5	12.7	0.0	12.1	0.6	0.1	0.0	20.5	3.4
Phalen Seam/															
Phalen Colliery:	Roof														
Sandstone															
Roof	0.00 - 0.15	50.4	4.2	2.8	4.4	13.3	0.6	12.8	0.6	0.0	0.1	0.9	0.1	7.5	2.3
	0.15 - 0.30	57.3	4.7	4.8	4.5	8.3	1.3	9.7	0.0	0.9	0.0	0.0	0.3	7.0	1.1
	0.30 - 0.45	73.4	4.8	1.1	6.8	0.7	0.1	2.7	1.0	0.0	3.7	0.5	0.1	4.1	1.0
	0.45 - 1.35*	25.7	5.2	8.7	10.5	7.4	0.1	14.4	0.0	7.8	0.1	0.0	0.9	15.1	4.1
	1.35 - 1.45	60.6	17.9	2.8	3.7	1.0	0.0	4.2	1.2	1.9	0.0	0.5	0.0	4.6	1.8
	Parting 0.05														
	1.50 - 1.65	68.6	5.4	6.2	3.5	4.5	0.0	4.1	0.0	0.4	0.0	0.3	0.0	5.5	1.5
	1.65 - 1.98*	56.8	15.9	3.4	2.2	2.4	0.0	6.8	0.3	1.5	0.0	0.1	0.6	2.3	7.6
	Floor														
	Average'	44.2	7.6	5.9	7.0	6.0	0.2	10.4	0.2	4.1	0.3	0.2	0.6	9.5	3.8

FIGURE III.11

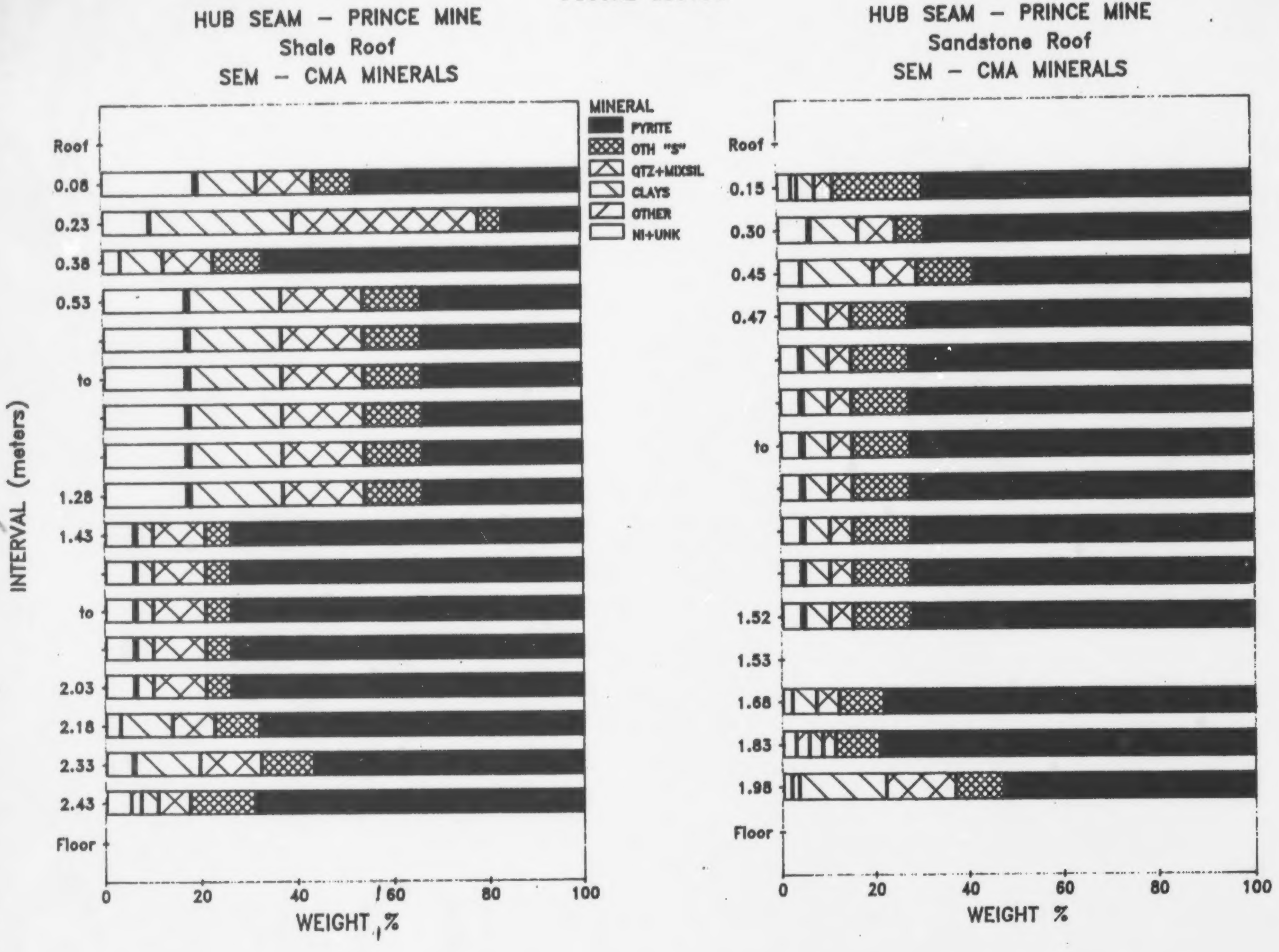
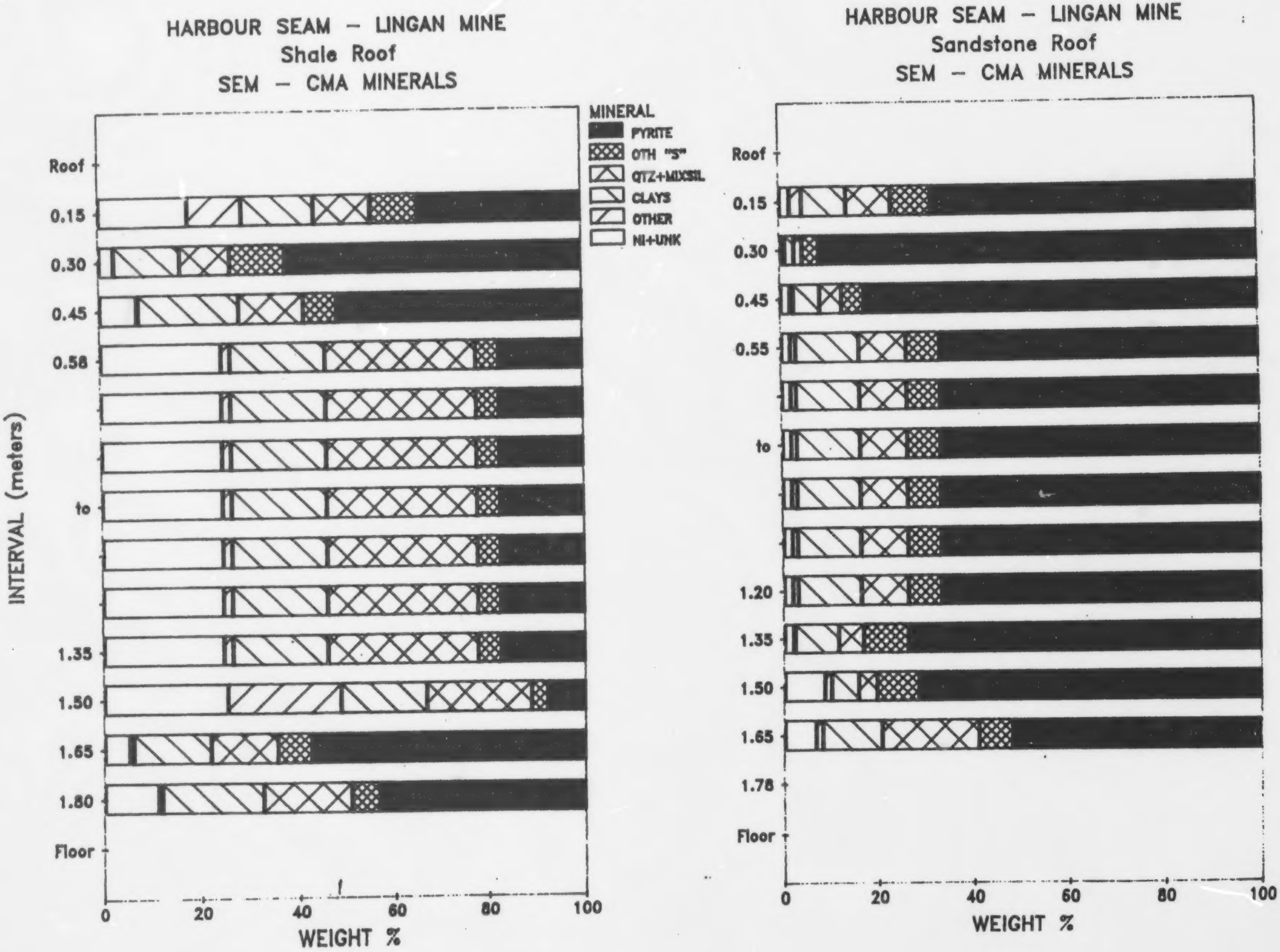


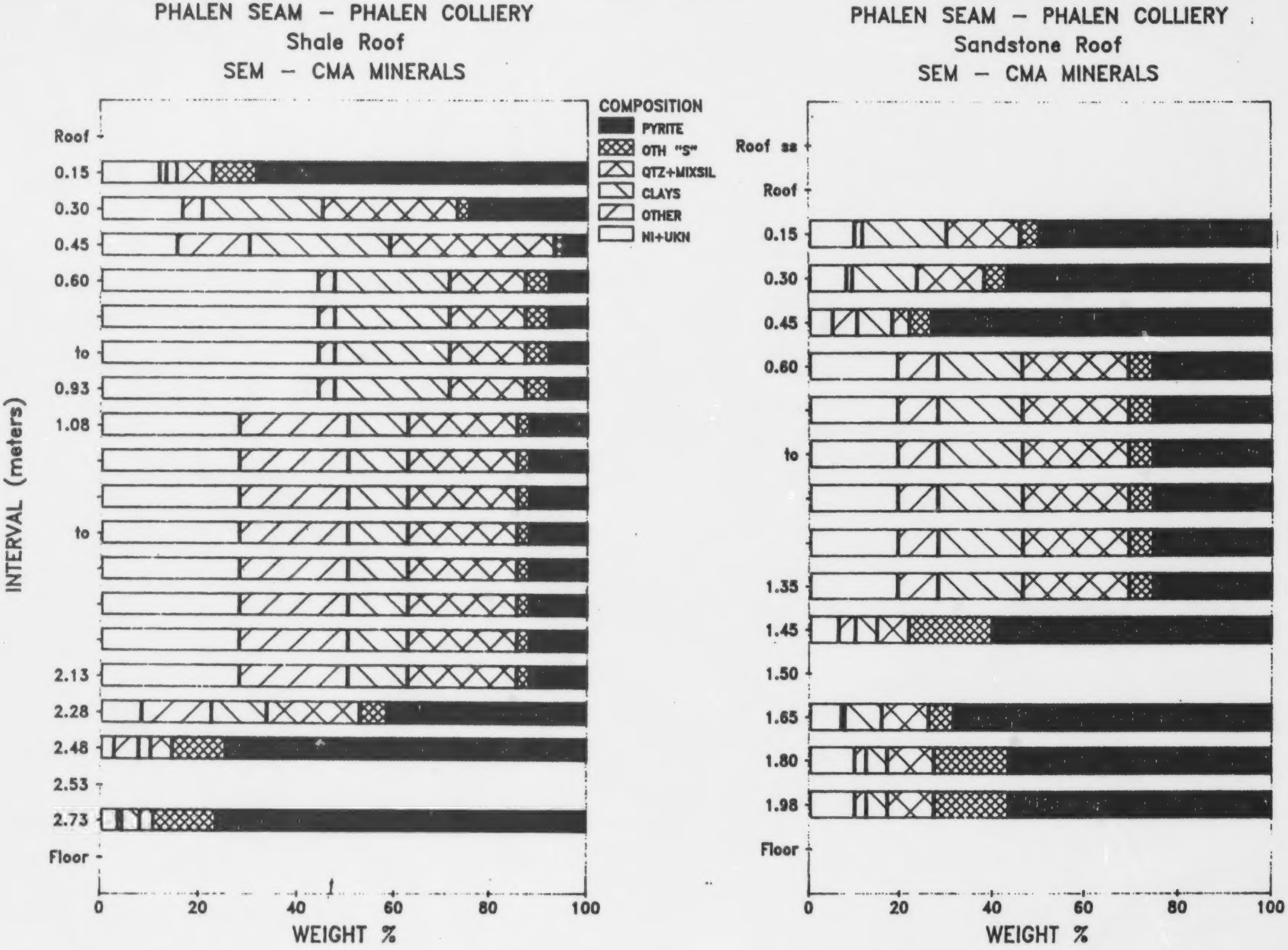
FIGURE III. 12



HARBOUR SEAM – LINGAN MINE
Shale Roof
SEM – CMA MINERALS

HARBOUR SEAM – LINGAN MINE
Sandstone Roof
SEM – CMA MINERALS

FIGURE III.13



PHALEN SEAM – PHALEN COLLIERY
Shale Roof
SEM – CMA MINERALS

PHALEN SEAM – PHALEN COLLIERY
Sandstone Roof
SEM – CMA MINERALS

APPENDIX III

C. Scanning Electron Microscopy

ii) Raw Data

1. Hub Seam - Prince Mine

Shale Roof

```
SAMPLE: 88-268-02A     0.00 - 0.08 m

NUMBER     1  DISK   160     FILE 355 - 359  PARTICLES                              RUN/T   86.00

RUN        1  DATE  5/11/88  SUMMARY   358   TOTAL   490     MASS 5.2E+00  UG/CM2   ANAL./T 73.00

BLOCKS    25  TIME 10:11     OFF-PT.        > 50U     7    > 50U 3.3E+00  UG/CM2   DEAD/T  13.00

                                   WEIGHT DISTRIBUTION

           TYPE        0.2-1  1-2.5  2.5-5   5-10  10-20    +20  TOTAL

            QUARTZ...      0      1     42     28      0     29    2.0

            KAOLINITE      1      4     24      9     63      0    7.2

            ILLITE...      0      6     20     54     11      7    4.9

            PYRITE...      0      0      4      3     23     70   47.8

            FE-SUL...      0      0      0      4     30     67    6.1

            QUARPYR..      3      8     15     19     55      0    2.0

            MIXSIL...      0      2      9     12     43     34    8.2

            NOT-INT..      0      1     11     10     24     55   18.2

            MISC.....      2      7     18     28     16     29    3.5

            TOTAL....      0      1      9      9     28     52  100.0



                                AVERAGE COMPOSITION
            TYPE          AVE   NA   MG   AL   SI    S   CL    P    K   CA   TI   FE   WT%
            QUARTZ...    4.02    1         0   92    3    0         2    1    2    1   2.0
            KAOLINITE    2.40    0        41   48    3    1         2    1    1    3   7.2
            ILLITE...    1.41    1        32   44    8    0        12    0    2    2   4.9
            ORGSULF..   14.50    1         3        83                   1    4    9   0.1
            PYJAR....    2.19    0    0   10    6   51              4    1    2   25   0.1
            PYRITE...    6.96    0    1    2    2   62              0    0    1   32  47.8
            SIDERITE.   22.40                   6   20                             73   0.7
            MONTMORIL    4.24             22   62    9                        5    1   0.1
            FE-SUL...   16.77              3    3   46              1    1    0   47   6.1
            QUARORG..    1.02    0        26   35   22    3         6    2    2    4   1.4
            QUARPYR..    1.10    1    0   24   39   17    1         5    2    2   10   2.0
            MIXSIL...    4.63    1        35   49    3    2         6    2    2    5   8.2
            NOT-INT..    5.14    0    1   22   30   12    3    2   12    4    6   14  18.2
            UNKNOWN..    4.68    1        26   22   12    3         4    2   18   11   1.1
```

```
SAMPLE: 88-268-02A     0.00 - 0.08 m

NUMBER      1  DISK   160     FILE 355 - 359  PARTICLES                               RUN/T   86.00

RUN         1  DATE  5/11/88  SUMMARY   358   TOTAL   490     MASS 5.2E+00  UG/CM2   ANAL./T 73.00

BLOCKS     25  TIME 10:11     OFF-PT.         ) 50U      7   ) 50U 3.3E+00  UG/CM2   DEAD/T  13.00

TABLE USED TO SCALE DATA

                    RUN PARAMETER TABLE
  MAG     BIN      XL       XU      PARTS  FIELDS  SCALE    MASS

  500      0      0.2      1.0        23   20.00      6  1.47E-02

  500      1      1.0      2.5        74   20.00      6  7.68E-02

  150      2      2.5      5.0       149    2.40      5  4.56E-01

  150      3      5.0     10.0        51    2.40      5  4.87E-01

   50      4     10.0     20.0       135    1.35      1  1.41E+00

   50      5     20.0     50.0        58    1.35      1  2.68E+00




                                    SIZE DISTRIBUTION

  TYPE             0.2-1    1-2.5    2.5-5    5-10    10-20    +20      PART/CM2   %TOTAL
   QUARTZ...          0        7       76      16        0      1       2.1E+03     2.6
   KAOLINITE         50       13       27       4        6      0       1.4E+04    17.1
   ILLITE...         66       15       11       8        1      0       2.0E+04    24.8
   ORGSULF..          0        0        0       0      100      0       2.3E+01     0.0
   PYJAR....          0       73       27       0        0      0       4.2E+02     0.5
   PYRITE...         17       17       34       8       13     11       5.7E+03     6.8
   SIDERITE.          0        0        0       0        0    100       2.3E+01     0.0
   MONTMORIL          0        0      100       0        0      0       1.1E+02     0.1
   FE-SUL...          0        0        0      24       48     28       4.8E+02     0.6
   QUARORG..         76       15        6       3        1      0       1.3E+04    16.1
   QUARPYR..         75       16        6       2        1      0       1.1E+04    13.7
   MIXSIL...         18       24       30      17       10      1       4.8E+03     5.7
   NOT-INT..          8       16       53      11        7      4       9.0E+03    10.8
   UNKNOWN..          0       16       59      23        0      2       9.9E+02     1.2

   TOTAL....         50       16       22       7        4      2       8.4E+04   100.0
```

```
SAMPLE: 88-268-02B     0.08 - 0.23 m

NUMBER      1  DISK   161     FILE 365 - 369  PARTICLES                         RUN/T  114.99

RUN         1  DATE  5/11/88  SUMMARY   368   TOTAL   531     MASS 8.3E-01  UG/CM2  ANAL./T 90.00

BLOCKS     28  TIME 14:38     OFF-PT.        ) 50U     13    ) 50U 6.9E-01  UG/CM2  DEAD/T  24.99

                                    WEIGHT DISTRIBUTION

             TYPE         0.2-1   1-2.5   2.5-5   5-10    10-20    +20   TOTAL

              QUARTZ...      0       5      33      36      23       3     8.1

              KAOLINITE      2      10      21      26      18      22    21.9

              ILLITE...      2      32      29      10       7      20     7.3

              PYRITE...      1       1      10       3       8      77    16.8

              FE-SUL...      0       0       0       0      19      81     2.0

              QUARORG..     11      47      35       0       6       0     3.3

              QUARPYR..      3      13      39      45       0       0     2.8

              MIXSIL...      2       9       6       5      17      62    27.1

              NOT-INT..      2      32      15      11      18      21     6.7

              UNKNOWN..      2      45      24       0       7      22     3.1

              MISC.....     25      34      20       0      21       0     0.9

              TOTAL....      2      13      17      13      14      40   100.0


                                    AVERAGE COMPOSITION
               TYPE        AVE     NA    MG    AL    SI     S    CL     P     K    CA    TI    FE    WT%
              QUARTZ...   4.29            0     0    95           0           1     0     0     1    8.1
              KAOLINITE   1.57      1          42    47     3     0           1     0     3     3   21.9
              ILLITE...   0.69                 34    42     2     1          11     3     7     4    7.3
              PYJAR....   0.54            1    11          58     1           4                25    0.2
              PYRITE...   2.56      1           2     2    61                 1     1     1    32   16.8
              CALCITE..   2.64      3     1     8     1     6     2           4    70           5    0.1
              RUTILE...   1.22                  6     2     4           0           0    85     2    0.2
              MONTMORIL   1.97      0          15    74     2     2           0     3     2     1    0.4
              FE-SUL...  23.11                  1     1    53     0                 0          44    2.0
              QUARORG..   1.24      1     0    48    27    12     2     1     6     2     4     2    3.3
              QUARPYR..   1.78      0     0    42    26    12     1           4     3     4     8    2.8
              MIXSIL...   1.75      0          46    42     3     1           3     1     3     2   27.1
              NOT-INT..   0.47      0          57    24     4     6           1     1     1     6    6.7
              UNKNOWN..   1.76      2     0    58    12     3     2     1     3     2    14     4    3.1
```

```
SAMPLE: 88-268-028      0.08 - 0.23 m

NUMBER     1  DISK   161     FILE 365 - 369  PARTICLES                                         RUN/T  114.99

RUN        1  DATE  5/11/88  SUMMARY   368   TOTAL    531     MASS 8.3E-01  UG/CM2   ANAL./T 90.00

BLOCKS    28  TIME 14:38     OFF-PT.         ) 50U     13    ) 50U 6.9E-01  UG/CM2   DEAD/T  24.99

TABLE USED TO SCALE DATA

                    RUN PARAMETER TABLE
   MAG    BIN     XL      XU      PARTS  FIELDS  SCALE     MASS

   500     0      0.2     1.0       28   20.00      60  1.77E-02

   500     1      1.0     2.5      115   20.00      60  1.07E-01

   150     2      2.5     5.0      159    8.07      13  1.38E-01

   150     3      5.0    10.0       42    8.07      13  1.08E-01

    50     4     10.0    20.0      125   12.17       1  1.17E-01

    50     5     20.0    50.0       62   12.17       1  3.26E-01


                                      SIZE DISTRIBUTION

    TYPE             0.2-1   1-2.5   2.5-5   5-10    10-20    +20      PART/CM2   %TOTAL
     QUARTZ...          0      21      52     23        3      0       1.4E+03     1.7
     KAOLINITE         58      24      12      5        1      0       1.3E+04    15.1
     ILLITE...         75      20       4      1        0      0       1.8E+04    21.1
     PYJAR....        100       0       0      0        0      0       1.2E+03     1.4
     PYRITE...         52      15      26      3        2      2       1.0E+03     1.2
     CALCITE..          0       0     100      0        0      0       4.6E+01     0.1
     RUTILE...         86       0      14      0        0      0       2.8E+02     0.3
     MONTMORIL          0      99       0      0        1      0       3.1E+02     0.4
     FE-SUL...          0       0       0      0       40     60       1.3E+01     0.0
     QUARORG..         57      36       7      0        0      0       6.2E+03     7.1
     QUARPYR..         55      22      18      5        0      0       2.0E+03     2.4
     MIXSIL...         55      34       7      2        1      1       9.4E+03    10.6
     NOT-INT..         84      14       1      0        0      0       3.1E+04    35.5
     UNKNOWN..         19      70      10      0        0      0       2.8E+03     3.3

     TOTAL....         69      23       7      2        0      0       8.8E+04   100.0
```

```
SAMPLE: 88-268-02C     0.23 - 0.38 m

NUMBER     1  DISK   161     FILE 370 - 373  PARTICLES                        RUN/T  146.00

RUN        1  DATE  5/12/88  SUMMARY   372   TOTAL   381     MASS 1.0E+00  UG/CM2  ANAL./T 80.99

BLOCKS    22  TIME  8:51     OFF-PT.       > 50U     42    > 50U 4.2E+00  UG/CM2  DEAD/T  65.00

                                    WEIGHT DISTRIBUTION

          TYPE          0.2-1   1-2.5   2.5-5   5-10    10-20    +20   TOTAL

           KAOLINITE       0       2      19     24       19     36     8.3

           PYRITE...       0       0       6     10        8     76    66.6

           FE-SUL...       0       0       0      4       10     86     9.0

           MIXSIL...       0       7       7      1       17     68     8.4

           NOT-INT..       2      13      18     11       25     32     2.9

           MISC.....       2      21      28     25       23      0     4.8

           TOTAL....       0       2       8     11       11     68   100.0



                                    AVERAGE COMPOSITION
  TYPE          AVE    NA    MG    AL    SI     S    CL     P     K    CA    TI    FE    WT%
QUARTZ...      4.86     0     0          95     1     0           1     1     1     1    1.3
KAOLINITE      4.62     0          43    48     2     1           2     2     2     2    8.3
ILLITE...      2.45                35    44     4     1          10     1     1     3    0.7
ORGSULF..      2.91     1     2     2          72                       2          21    0.0
PYJAR....      3.85     1     1     3     3    60     0           3     1     2    27    0.8
PYRITE...      7.56     0     0     1     1    63                 1     0     1    33   66.6
RUTILE...      2.63           1     6     4           1     2     2     2    82     1    0.0
FE-SUL...     20.81                 2     2    47                 0     1     1    48    9.0
QUARORG..      2.43     1          89           5     1     1     1     1     2     1    0.6
QUARPYR..      0.35     1          68     3    13     4     3     0     2           6    0.5
MIXSIL...      3.86     1          46    46     2     1           1     1     2     3    8.4
NOT-INT..      1.80     1     0    40    21    12     4     2     3     3     4    11    2.9
UNKNOWN..      1.52     1          82     2           2     1     1     1     7     2    0.8
```

```
SAMPLE: 88-268-02C      0.23 - 0.38 m

NUMBER     1  DISK   161     FILE 370 - 373  PARTICLES                        RUN/T  146.00

RUN        1  DATE  5/12/88  SUMMARY   372   TOTAL    381     MASS 1.0E+00  UG/CM2  ANAL./T 80.99

BLOCKS    22  TIME  8:51     OFF-PT.        > 50U     42    > 50U 4.2E+00  UG/CM2  DEAD/T  65.00

TABLE USED TO SCALE DATA

                        RUN PARAMETER TABLE
   MAG     BIN      XL       XU      PARTS  FIELDS  SCALE     MASS

   500      0      0.2      1.0         3   20.00      51  1.80E-03

   500      1      1.0      2.5        21   20.00      51  2.46E-02

   150      2      2.5      5.0       143   17.00       5  8.00E-02

   150      3      5.0     10.0        56   17.00       5  1.10E-01

    50      4     10.0     20.0        78   10.33       1  1.15E-01

    50      5     20.0     50.0        80   10.33       1  7.01E-01




                                  SIZE DISTRIBUTION

   TYPE              0.2-1    1-2.5    2.5-5    5-10     10-20     +20       PART/CM2   %TOTAL
    QUARTZ...           0        0       77      15         9       0        2.2E+02      1.6
    KAOLINITE           0       26       46      22         4       2        1.2E+03      9.2
    ILLITE...           0       70       22       7         1       0        4.7E+02      3.4
    ORGSULF..           0        0      100       0         0       0        1.6E+01      0.1
    PYJAR....           0        0       72      28         0       0        1.7E+02      1.3
    PYRITE...           0       10       48      25         6      10        1.5E+03     11.0
    RUTILE...           0        0      100       0         0       0        2.6E+01      0.2
    FE-SUL...           0        0        0      41        22      37        8.0E+01      0.6
    QUARORG..           0       88        9       3         0       0        5.2E+02      3.8
    QUARPYR..          97        0        2       1         0       0        5.1E+03     37.5
    MIXSIL...           0       63       30       2         4       2        9.8E+02      7.2
    NOT-INT..          35       51       10       2         1       0        1.9E+03     14.4
    UNKNOWN..          36       61        3       0         0       0        1.3E+03      9.6

    TOTAL....          45       27       18       7         2       2        1.3E+04    100.0
```

```
SAMPLE: 88-268-02COMP. D-1    0.38 - 1.28 m

NUMBER     1  DISK   163     FILE 440 - 443  PARTICLES                          RUN/T  !62.00

RUN        1  DATE  5/19/88  SUMMARY   442   TOTAL   440    MASS 1.0E+00  UG/CM2   ANAL./T!99.00

BLOCKS    23  TIME  8:36     OFF-PT.        > 50U     12    > 50U 3.1E-01  UG/CM2   DEAD/T  63.00

                                 WEIGHT DISTRIBUTION

         TYPE            0.2-1   1-2.5   2.5-5    5-10   10-20     +20   TOTAL

          KAOLINITE          0       2      26      42      23       7    15.5

          ILLITE...          2       8      32      44       8       7     3.6

          PYRITE...          1      10       4      16      30      39    33.9

          FE-SUL...          0       0       2       0      22      76     8.9

          QUARORG..          6      19      39      31       4       0     2.8

          QUARPYR..          0       5      23      72       0       0     2.6

          MIXSIL...          0       3      17      21      19      41    13.0

          NOT-INT..          0       2      23      20      11      43    16.7

          MISC.....          5       5      43      25      22       0     3.0

          TOTAL....          1       5      16      23      21      34   100.0




                                AVERAGE COMPOSITION
  TYPE           AVE     NA    MG    AL    SI     S    CL     P     K    CA    TI    FE    WT%
QUARTZ...       4.63      0     0          94     2     1           1     1     0     1    1.1
KAOLINITE       4.49      0          43    48     2     0           1     1     1     2   15.5
ILLITE...       2.45      1          33    47     3     2     0     9     2     2     2    3.6
GYPSUM...       1.61            1    18     1    37     3     2          34     3          0.1
ORGSULF..       1.70                  6     3    70                 1     3          17    0.1
PYJAR....       1.65      0     1     4     2    59                 4     2          28    0.6
PYRITE...       2.60            1     2     2    62                 0           2    32   33.9
SIDERITE.       5.86      1           2     1    10           0     0     2     3    82    0.7
FE-SUL...      12.20            0     2     2    49     0           1     0     1    46    8.9
QUARORG..       0.48      1          49     7    24     1     2     7     3     1     7    2.8
QUARPYR..       3.12      1          57     5    19     2     1     2     2     2    11    2.6
MIXSIL...       4.06      0          40    47     3     1           4     2     2     3   13.0
UNKCHLOR.       3.35     25           1                71                 2     1          0.1
NOT-INT..       1.43      !     1    54    16    11     3     3     4     4     3     9   16.7
UNKNOWN..       0.84      2          46    23     4     6     0     6     3     8     1    0.4
```

```
SAMPLE: 88-268-02COMP. D-I        0.38 - 1.28 m

NUMBER     1  DISK   163     FILE 440 - 443  PARTICLES                              RUN/T  !62.00

RUN        1  DATE  5/19/88  SUMMARY   442   TOTAL    440    MASS 1.0E+00  UG/CM2   ANAL./T!99.00

BLOCKS    23  TIME  8:36     OFF-PT.        > 50U     12    > 50U 3.1E-01  UG/CM2   DEAD/T  63.00

TABLE USED TO SCALE DATA

                   RUN PARAMETER TABLE
   MAG    BIN     XL      XU     PARTS  FIELDS  SCALE    MASS

   500     0     0.2     1.0        9   20.00      48  6.71E-03

   500     1     1.0     2.5       43   20.00      48  5.41E-02

   150     2     2.5     5.0      140    6.68      13  1.56E-01

   150     3     5.0    10.0       60    6.68      13  2.27E-01

    50     4    10.0    20.0      136    9.67       1  2.06E-01

    50     5    20.0    50.0       52    9.67       1  3.33E-01




                              SIZE DISTRIBUTION

    TYPE           0.2-1   1-2.5   2.5-5   5-10    10-20    +20      PART/CM2   %TOTAL
     QUARTZ...        0       0      76     19       4       0       2.1E+02     0.5
     KAOLINITE        0      20      48     27       4       0       3.1E+03     7.7
     ILLITE...       28      37      25     10       0       0       1.6E+03     4.1
     GYPSUM...        0     100       0      0       0       0       1.5E+02     0.4
     ORGSULF..        0     100       0      0       0       0       1.5E+02     0.4
     PYJAR....       77       0      22      0       1       0       3.7E+02     0.9
     PYRITE...       18      64      10      5       3       1       4.3E+03    10.4
     SIDERITE.        0       0      48     48       4       0       8.6E+01     0.2
     FE-SUL...        0       0      48      0      28      24       1.7E+02     0.4
     QUARORG..       90       6       3      1       0       0       1.6E+04    40.1
     QUARPYR..        0      56      25     20       0       0       8.4E+02     2.0
     MIXSIL...        0      39      41     14       3       2       2.0E+03     4.9
     UNKCHLOR.        0       0     100      0       0       0       4.2E+01     0.1
     NOT-INT..       63      13      18      5       1       0       9.9E+03    24.0
     UNKNOWN..       92       0       5      3       0       0       1.6E+03     3.9

    TOTAL....        59      19      15      6       1       0       4.1E+04   100.0
```

```
SAMPLE: 88-268-02 COMP. J-N        1.28 - 2.03 m

NUMBER     1  DISK   163    FILE 449 - 453  PARTICLES                                  RUN/T  102.00

RUN        1  DATE  5/20/88  SUMMARY   452   TOTAL    500     MASS 2.3E+00  UG/CM2   ANAL./T 76.00

BLOCKS    26  TIME  9:40    OFF-PT.         ) 50U      6    ) 50U 2.6E-01  UG/CM2   DEAD/T  26.00

                                     WEIGHT DISTRIBUTION

              TYPE           0.2-1   1-2.5   2.5-5    5-10   10-20     +20   TOTAL

               QUARTZ...         0       0       4       0       9      86     5.6

               KAOLINITE         1       9      37      17      10      26     2.0

               PYRITE...         0       4      13      29      20      34    73.8

               FE-SUL...         0       1       4       8      15      73     3.4

               MIXSIL...         0       2      16      12      19      51     4.0

               NOT-INT..         1      12       9      12      31      35     5.0

               MISC.....         5      21      29      15      18      14     6.2

               TOTAL....         1       5      13      24      19      37   100.0




                                   AVERAGE COMPOSITION
 TYPE         AVE   NA   MG   AL   SI    S   CL    P    K   CA   TI   FE   WT%
QUARTZ...    6.34         0    1   94    1    1         1    1    1    2   5.6
KAOLINITE    2.98    1        40   48    3    1         1    2    2    2   2.0
ILLITE...    3.57    1        32   44    5    2        11    2    2    3   1.3
PYJAR....    1.29    1    1    5    4   59              4    0    1   26   0.9
PYRITE...    3.23    0    0    2    2   62              1    1    1   32  73.8
SIDERITE.    3.80              2    5   23              2    1        66   0.1
CALCITE..    5.58    1    2    4    2    8              1   74         9   0.5
MONTMORIL   11.86    1        14   79         1         2    3         1   0.1
FE-SUL...    5.83         0    3    2   50              1    1    1   44   3.4
QUARORG..    0.56             30   29   20    0        10    1         7   1.3
QUARPYR..    1.59    0    2   32   11   32    2    0    2    2    2   16   1.0
MIXSIL...    4.71    1        36   50    4    2         3    2    3    3   4.0
NOT-INT..    0.78    2    1   25   26   20    3    0    8    3    2   10   5.0
UNKNOWN..    2.85    2    0   52   11    7    2    4    4    1    9    7   1.0
```

```
SAMPLE: 88-268-02 COMP. J-N      1.28 - 2.03 m

NUMBER     1  DISK   163     FILE 449 - 453  PARTICLES                         RUN/T  102.00

RUN        1  DATE  5/20/88  SUMMARY   452   TOTAL   500     MASS 2.3E+00  UG/CM2  ANAL./T 76.00

BLOCKS    26  TIME  9:40     OFF-PT.        ) 50U     6    ) 50U 2.6E-01  UG/CM2  DEAD/T  26.00

TABLE USED TO SCALE DATA

                      RUN PARAMETER TABLE
   MAG    BIN     XL      XU      PARTS  FIELDS  SCALE    MASS

   500     0     0.2     1.0        18   20.00      26  1.39E-02

   500     1     1.0     2.5        88   20.00      26  1.22E-01

   150     2     2.5     5.0       135    4.90       9  3.09E-01

   150     3     5.0    10.0        65    4.90       9  5.52E-01

    50     4    10.0    20.0       124    5.32       1  4.47E-01

    50     5    20.0    50.0        70    5.32       1  8.64E-01




                                SIZE DISTRIBUTION

      TYPE            0.2-1   1-2.5   2.5-5   5-10    10-20    +20     PART/CM2  %TOTAL
       QUARTZ...        0      49      32      0       6       13      5.3E+02     0.8
       KAOLINITE       26      27      38      7       1        1      1.6E+03     2.6
       ILLITE...        0      31      51     16       3        0      1.0E+03     1.6
       PYJAR....       50      38       9      2       0        0      2.3E+03     3.6
       PYRITE...       24      34      23     16       2        1      1.8E+04    27.5
       SIDERITE.        0       0     100      0       0        0      5.7E+01     0.1
       CALCITE..        0       0      91      0       0        9      6.2E+01     0.1
       MONTMORIL        0       0       0      0     100        0      6.2E+00     0.0
       FE-SUL...        0      47      25     12       7        9      4.9E+02     0.7
       QUARORG..       85      12       2      0       0        0      1.8E+04    28.6
       QUARPYR..       37      52      11      0       0        0      2.6E+03     4.1
       MIXSIL...        0      28      50     16       5        2      1.0E+03     1.7
       NOT-INT..       78      16       4      1       1        0      1.7E+04    27.4
       UNKNOWN..       43      19      29      7       1        1      7.9E+02     1.2

       TOTAL....       57      24      12      6       1        1      6.5E+04   100.0
```

```
SAMPLE: 88-268-020       2.03 - 2.18 m

NUMBER     1  DISK   161     FILE 374 - 378  PARTICLES                               RUN/T  200.99

RUN        1  DATE  5/12/88  SUMMARY   377   TOTAL   570     MASS 6.8E+00  UG/CM2   ANAL./T118.00

BLOCKS    29  TIME 11:43     OFF-PT.        > 50U      4    > 50U 1.0E+00  UG/CM2   DEAD/T  82.99

                                       WEIGHT DISTRIBUTION

           TYPE           0.2-1   1-2.5   2.5-5   5-10    10-20    +20   TOTAL

            QUARTZ...       0       4      37      59       0       0     1.9

            KAOLINITE       0       3      15      44      33       5     4.2

            ILLITE...       0       3      19      58       8      11     6.1

            PYRITE...       0       1      10      14      34      42    68.0

            FE-SUL...       0       0       0       0      24      76     6.4

            QUARORG..       6      31      13      46       5       0     1.7

            QUARPYR..       2      11      23       0      15      49     1.6

            MIXSIL...       1       3      32      28      15      21     5.2

            NOT-INT..       0      11      13       0      39      36     2.9

            MISC.....       1       8      40      42      10       0     2.0

            TOTAL....       0       2      13      19      29      37   100.0



                                         AVERAGE COMPOSITION
            TYPE           AVE      NA     MG     AL     SI     S      CL     P      K      CA     TI     FE    WT%
           QUARTZ...      4.52       1      1      1     92      3      2             2      1      1      1    1.9
           KAOLINITE      4.74       1            40     49      4      1             2      2      2      3    4.2
           ILLITE...      3.08       0            28     46      7      2            11      2      2      5    6.1
           PYJAR....      1.87       0      0      7      2     59      0             4      1      1     26    1.3
           PYRITE...      5.25       0             2      3     61                    0      0      2     31   68.0
           SIDERITE.      3.35              1             7     10      2             1      3      2     74    0.1
           MONTMORIL      6.36       0            17     74      5      2                    1             2    0.4
           FE-SUL...      6.28              1      2      2     46      0      0      0      1      2     46    6.4
           QUARORG..      0.60       1            25     43     19      3             5      0      1      4    1.7
           QUARPYR..      1.42       1      0     19     45     18      2             4      3      0     10    1.6
           MIXSIL...      2.53       0      0     24     58      3      2             4      2      2      3    5.2
           MIXSUL...     11.07              1      3      1     52      1                    6      5     31    0.1
           NOT-INT..      1.82       1      2     22     31     14      2      1      7      5      7     13    2.9
           UNKNOWN..      0.31                    18     39     13      2             0      3     17      9    0.1
```

```
SAMPLE: 88-268-020      2.03 - 2.18 m

NUMBER     1  DISK   161     FILE 374 - 378  PARTICLES                                RUN/T  200.99

RUN        1  DATE  5/12/88  SUMMARY   377   TOTAL   570     MASS 6.8E+00  UG/CM2   ANAL./T118.00

BLOCKS    29  TIME 11:43     OFF-PT.        ) 50U      4    ) 50U 1.0E+00  UG/CM2   DEAD/T  82.99

TABLE USED TO SCALE DATA

                     RUN PARAMETER TABLE
   MAG    BIN     XL      XU     PARTS  FIELDS  SCALE    MASS

   500     0     0.2     1.0       30   20.00       7  2.08E-02

   500     1     1.0     2.5      144   20.00       7  1.62E-01

   150     2     2.5     5.0      131    1.58       8  8.42E-01

   150     3     5.0    10.0       69    1.58       8  1.26E+00

    50     4    10.0    20.0      142    1.45       1  1.92E+00

    50     5    20.0    50.0       54    1.45       1  2.47E+00




                                SIZE DISTRIBUTION

   TYPE              0.2-1   1-2.5   2.5-5   5-10    10-20    +20      PART/CM2  %TOTAL
    QUARTZ...           0      19      43     38        0      0       3.2E+03     2.2
    KAOLINITE           0      29      33     32        6      0       4.9E+03     3.4
    ILLITE...          36      18      24     20        1      0       1.2E+04     8.8
    PYJAR....          39      26      30      4        1      0       4.1E+03     2.8
    PYRITE...          16      14      38     18       10      3       2.1E+04    14.4
    SIDERITE.           0       0     100      0        0      0       1.7E+02     0.1
    MONTMORIL           0       0       0    100        0      0       3.5E+02     0.2
    FE-SUL...          60      11       0      0       15     14       1.6E+03     1.1
    QUARORG..          85      12       2      1        0      0       5.2E+04    35.7
    QUARPYR..          57      26      15      0        1      0       8.6E+03     5.9
    MIXSIL...          42      11      34     11        1      0       1.3E+04     9.4
    MIXSUL...           0       0       0      0      100      0       2.4E+01     0.0
    NOT-INT..          28      58      10      0        3      1       9.6E+03     6.5
    UNKNOWN..          94       4       1      0        0      0       1.4E+04     9.5

    TOTAL....          56      17      16      8        2      1       1.4E+05   100.0
```

```
SAMPLE: 88-268-02P      2.18 - 2.33 m

NUMBER     1  DISK   161     FILE 379 - 383  PARTICLES                        RUN/T  113.99

RUN        1  DATE  5/12/88  SUMMARY   382   TOTAL   578     MASS 7.3E+00  UG/CM2   ANAL./T108.99

BLOCKS    30  TIME 14:50     OFF-PT.        > 50U     6    > 50U 1.4E+00  UG/CM2   DEAD/T   4.99

                                         WEIGHT DISTRIBUTION

             TYPE          0.2-1   1-2.5   2.5-5   5-10    10-20    +20   TOTAL

              QUARTZ...      0       0      11      14      16      59     4.3

              KAOLINITE      0       9      35       4      40      11     3.9

              ILLITE...      1       3      15      14      15      51     9.0

              PYJAR....      1       6      38      19      19      17     2.0

              PYRITE...      0       1      14      30      37      18    56.7

              FE-SUL...      0       0       9       3      37      50     5.1

              QUARPYR..      1       4      10      21      37      27     3.4

              MIXSIL...      0       3       8       7      35      47     7.3

              NOT-INT..      0      10      10       4      49      27     4.5

              MISC.....      3       9      23      10      43      11     3.7

              TOTAL....      0       2      15      21      34      27   100.0



                                           AVERAGE COMPOSITION
             TYPE          AVE     NA    MG    AL    SI     S    CL     P     K    CA    TI    FE   WT%
            QUARTZ...      5.13     0           2    92     2     1           2     0     1     2   4.3
            KAOLINITE      3.43     0          39    46     5     1           3     1     2     4   3.9
            ILLITE...      1.40     1     2    26    47    13     1           7     1     2     2   9.0
            PYJAR....      2.69     1     0     7     5    57     0           3     0     1    26   2.0
            PYRITE...      5.62     0     0     3     2    61                 1     1     1    32  56.7
            SIDERITE.      4.54     0     1     2     4    20                 1     1          72   0.4
            CALCITE..     12.30           7     5     3           3                66          16   0.1
            MONTMORIL      3.92     0     0    18    70     4     2           2     2     1     1   0.5
            FE-SUL...      7.04     1     0     3     2    48                 1     0     2    45   5.1
            QUARORG..      0.44     0     0    19    48    19     2           5     1     2     2   1.2
            QUARPYR..      0.71     0     0    27    34    18     0           8     2     1     9   3.4
            MIXSIL...      1.22     0          24    53     4     3           5     1     6     4   7.3
            MIXSUL...      1.07                 6     9    45     2           4     6     5    23   0.4
            NOT-INT..      2.66     1     1    24    38    12     2     1     9     4     3     8   4.5
            UNKNOWN..      4.70     1          36    24     6     2     1     4    15     7     6   1.1
```

```
SAMPLE: 88-268-02P    2.18 - 2.33 m

NUMBER     1  DISK   161     FILE 379 - 383  PARTICLES                                       RUN/T  113.99

RUN        1  DATE  5/12/88  SUMMARY   382   TOTAL   578     MASS 7.3E+00  UG/CM2   ANAL./T108.99

BLOCKS    30  TIME 14:50     OFF-PT.         > 50U      6    > 50U 1.4E+00  UG/CM2   DEAD/T   4.99

TABLE USED TO SCALE DATA

                     RUN PARAMETER TABLE
   MAG     BIN     XL      XU      PARTS  FIELDS  SCALE    MASS

   500      0      0.2     1.0       36   20.00       5  2.34E-02

   500      1      1.0     2.5      148   20.00       5  1.68E-01

   150      2      2.5     5.0      147    1.43       6  1.04E+00

   150      3      5.0    10.0       53    1.43       6  1.50E+00

    50      4     10.0    20.0      155    1.05       1  2.45E+00

    50      5     20.0    50.0       39    1.05       1  1.92E+00



                                     SIZE DISTRIBUTION

   TYPE             0.2-1   1-2.5   2.5-5   5-10   10-20    +20     PART/CM2   %TOTAL
    QUARTZ...         25       0      45     22       4      4      2.5E+03     1.2
    KAOLINITE          5      45      43      2       5      0      7.7E+03     3.7
    ILLITE...         72      10      14      3       1      1      3.3E+04    16.2
    PYJAR....         27      21      46      5       1      1      4.1E+03     2.0
    PYRITE...          5       9      48     28       9      2      2.3E+04    11.2
    SIDERITE.          0       0      93      0       7      0      4.1E+02     0.2
    CALCITE..          0       0       0      0     100      0      3.9E+01     0.0
    MONTMORIL          0      69       0     26       5      0      7.4E+02     0.4
    FE-SUL...          0       8      61     10      17      5      1.9E+03     0.9
    QUARORG..         93       5       1      0       0      0      5.7E+04    27.7
    QUARPYR..         88       5       4      2       1      0      3.5E+04    16.9
    MIXSIL...         78      10       7      2       2      1      2.7E+04    13.0
    MIXSUL...         79       9      11      0       1      0      3.4E+03     1.7
    NOT-INT..          0      80      13      2       5      1      9.1E+03     4.4
    UNKNOWN..          0      48      39      0      10      3      9.8E+02     0.5

    TOTAL....         65      13      14      5       2      1      2.0E+05   100.0
```

```
SAMPLE: 88-268-020   2.33 - 2.43 m

NUMBER     1  DISK   161     FILE 384 - 387  PARTICLES                           RUN/T   82.00

RUN        1  DATE  5/13/88  SUMMARY   386   TOTAL   468     MASS 7.1E+00  UG/CM2   ANAL./T 77.00

BLOCKS    24  TIME  8:54     OFF-PT.         > 50U      5   > 50U 1.6E+00  UG/CM2   DEAD/T   4.99

                                    WEIGHT DISTRIBUTION

               TYPE         .2-1.  1.-2.5   2.5-5.   5.-10  10-20    +20     TOTAL

              QUARTZ...        0       0       6       46     48       0       1.8

              ILLITE...        0       4      11       25     42      17       2.0

              PYJAR....        0       5      23        7     36      29       3.8

              PYRITE...        0       1       9       15     36      39      69.0

              SIDERITE.        0       0       0        0      0     100       2.1

              FE-SUL...        0       0       0        8     31      60       7.7

              QUARPYR..        1       5       8       25     43      18       2.0

              MIXSIL...        0       2      12       11     10      65       3.9

              NOT-INT..        0       1       2        3     36      57       4.2

              MISC.....        1       4      25       17     22      31       3.5

              TOTAL....        0       1       9       14     34      42     100.0


                                  AVERAGE COMPOSITION
            TYPE        AVE      NA     MG     AL     SI      S     CL      P      K     CA     TI     FE      WT%
          QUARTZ...     6.92             1            93      2      0             1      1      1      2      1.8
          KAOLINITE     4.71      0             40    49      4      1             2      2      2      3      1.5
          ILLITE...     1.97      0             26    47      6      2            11      4      1      4      2.0
          ORGSULF..     2.47      5      1       4     2     70                           2      2     15      0.1
          PYJAR....     3.75      1      0       6     6     55      1             4      1      2     26      3.8
          PYRITE...     5.05             0       2     2     62                    0      0      1     31     69.0
          SIDERITE.    40.85                     3     4     11                                        82      2.1
          FE-SUL...    12.71      0      0       3     2     48                    1      1      2     44      7.7
          QUARORG..     2.08      1      0      30    32     23      1             5      2      3      6      0.9
          QUARPYR..     0.77      1      1      16    32     23      2             9      3      2     12      2.0
          MIXSIL...     4.14      1      0      25    52      4      1             9      1      2      4      3.9
          MIXSUL...     1.64      3             14     5     44      0             4      7      1     24      0.0
          NOT-INT..     4.87      2      0      18    21     21      3      0      8      2      3     21      4.2
          UNKNOWN..    21.82      1             18    28     12      4            12      2      8     17      1.0
```

```
SAMPLE: 88-268-020  2.33 - 2.43 m

NUMBER     1 DISK   161     FILE 384 - 387  PARTICLES                            RUN/T   82.00

RUN        1 DATE  5/13/88  SUMMARY   386   TOTAL   468     MASS 7.1E+00  UG/CM2  ANAL./T 77.00

BLOCKS    24 TIME  8:54     OFF-PT.         ) 50U     5   ) 50U 1.6E+00  UG/CM2  DEAD/T   4.99

TABLE USED TO SCALE DATA

                 RUN PARAMETER TABLE
  MAG    BIN     XL      XU     PARTS  FIELDS  SCALE   MASS

  500     0      0.2     1.0      17   20.00       5  1.37E-02

  500     1      1.0     2.5      56   20.00       5  7.17E-02

  150     2      2.5     5.0     139    2.36       4  6.30E-01

  150     3      5.0    10.0      61    2.36       4  9.84E-01

   50     4     10.0    20.0     145    1.09       1  2.35E+00

   50     5     20.0    50.0      50    1.09       1  2.08E+00



                              SIZE DISTRIBUTION

 TYPE         .2-1.  1.-2.5   2.5-5.   5.-10  10-20    +20    PART/CM2  %TOTAL
QUARTZ...       0       0      22       67     11       0     1.0E+03     1.5
KAOLINITE       0       7      61       28      5       0     2.1E+03     3.1
ILLITE...      62      13      15        6      4       0     6.0E+03     8.8
ORGSULF..       0      28      72        0      0       0     5.5E+02     0.8
PYJAR....       0      31      56        6      5       1     3.8E+03     5.6
PYRITE...      21      10      38       17     11       3     2.4E+04    35.4
SIDERITE.       0       0       0        0      0     100     2.8E+01     0.0
FE-SUL...       0      13       0       36     32      19     1.3E+03     1.9
QUARORG..      35      41      22        0      2       1     3.8E+03     5.7
QUARPYR..      85       7       4        2      1       0     1.9E+04    27.8
MIXSIL...      23      25      38        7      3       4     3.2E+03     4.8
MIXSUL...      55      26      20        0      0       0     5.9E+02     0.9
NOT-INT..      32      34      10        5     14       6     2.4E+03     3.6
UNKNOWN..       0       0       0        0     33      67     8.4E+01     0.1

TOTAL....      41      14      26       10      7       2     6.8E+04   100.0
```

2. Hub Seam - Prince Mine

Sandstone Roof

```
SAMPLE: 88-268-03A     0.00 - 0.15 m

NUMBER     1  DISK   162     FILE 405 - 409  PARTICLES                          RUN/T  212.00

RUN        1  DATE  5/16/88  SUMMARY   408   TOTAL   479     MASS 3.0E+00  UG/CM2   ANAL./T 94.00

BLOCKS    25  TIME 10:46     OFF-PT.        > 50U     9    > 50U 1.4E+00  UG/CM2   DEAD/T 117.99

                                      WEIGHT DISTRIBUTION

              TYPE          .2-1.  1.-2.5   2.5-5.   5.-10  10-20    +20    TOTAL

             KAOLINITE        1      11       18       53      9       9      3.2

             PYRITE...        0       0        2        7     18      72     69.5

             FE-SUL...        0       0        0        3     10      87     16.6

             MIXSIL...        0       9       13       11     20      47      2.4

             NOT-INT..        4      48       10        1     21      16      2.5

             MISC.....        4       9       12       15     11      49      5.8

             TOTAL....        0       3        4        8     16      69    100.0



                                          AVERAGE COMPOSITION
              TYPE          AVE      NA    MG    AL    SI     S    CL    P    K    CA   TI   FE     WT%
             QUARTZ...     10.64      1     0          93     1     1         1     1    2    2     1.1
             KAOLINITE      3.51      0          42    50     3     2         1     1    2    2     3.2
             ILLITE...      2.09      0          33    45     4     2    0    9     1    2    4     0.5
             GYPSUM...      1.28            2     8     9    38     8         1    30         3     0.0
             PYJAR....      2.73      1           4     4    55     1         4     1    2   28     1.1
             PYRITE...      7.82            0     2     1    62               1     0    1   34    69.5
             HALITE...      5.22     16           2     4     2    68    1    1     4    2    2     0.4
             CALCITE..     11.47      1                       2               1    96         1     0.7
             MONTMORIL      2.94                 21    68          3               4         5     0.0
             FE-SUL...     19.90      0     0     1     2    48               1     1    1   46    16.6
             QUARORG..      0.64                 42    26    15     2         1     4    7    4     0.3
             QUARPYR..      0.53      2     0    31    13    28     4         4     2    2   15     1.1
             MIXSIL...      3.93      1          36    45     3     2    0    5     2    2    5     2.4
             UNKCHLOR.      5.56      2           6     4     4    70    2    2     8    2    0     0.2
             NOT-INT..      0.68      3     1    26    31     6    10    1    6     6    3   10     2.5
             UNKNOWN..      0.34      1          27    24    12     7         8     5    8    8     0.4
```

```
SAMPLE: 88-268-03A    0.00 - 0.15 m

NUMBER      1  DISK   162      FILE 405 - 409  PARTICLES                          RUN/T  212.00

RUN         1  DATE  5/16/88  SUMMARY   408   TOTAL   479     MASS 3.0E+00  UG/CM2  ANAL./T 94.00

BLOCKS     25  TIME 10:46      OFF-PT.         ) 50U      9    ) 50U 1.4E+00  UG/CM2  DEAD/T 117.99

TABLE USED TO SCALE DATA

                   RUN PARAMETER TABLE
   MAG    BIN      XL       XU      PARTS  FIELDS  SCALE     MASS

   500     0      0.2      1.0       19   20.00      20  1.18E-02

   500     1      1.0      2.5       69   20.00      20  7.76E-02

   150     2      2.5      5.0      125   11.35       3  1.04E-01

   150     3      5.0     10.0       75   11.35       3  2.34E-01

    50     4     10.0     20.0       97    4.13       1  4.69E-01

    50     5     20.0     50.0       94    4.13       1  2.03E+00



                             SIZE DISTRIBUTION

   TYPE          .2-1.  1.-2.5   2.5-5.   5.-10  10-20    +20      PART/CM2   XTOTAL
   QUARTZ...        0       0      38       38     12     12      6.4E+01     0.1
   KAOLINITE       11      43      23       21      1      1      2.8E+03     3.8
   ILLITE...       52      16      25        5      2      0      9.5E+02     1.2
   GYPSUM...        0     100       0        0      0      0      1.6E+02     0.2
   PYJAR....        0      68      24        5      2      1      5.1E+02     0.7
   PYRITE...       23      13      23       18     12     11      3.7E+03     4.8
   HALITE...        0       0      34       66      0      0      2.9E+02     0.4
   CALCITE..        0       0      77        0      0     23      3.2E+01     0.0
   MONTMORIL        0       0     100        0      0      0      2.7E+01     0.0
   FE-SUL...        0       0       6       22     26     46      4.3E+02     0.6
   QUARORG..       81      18       1        0      0      0      5.9E+03     7.7
   QUARPYR..       96       3       1        0      0      0      1.1E+04    14.7
   MIXSIL...        0      53      33        8      3      2      1.1E+03     1.5
   UNKCHLOR.        0       0      67       33      0      0      7.3E+01     0.1
   NOT-INT..       75      23       1        0      0      0      2.9E+04    38.0
   UNKNOWN..       96       3       1        0      0      0      2.0E+04    26.3

   TOTAL....       76      15       4        2      1      1      7.7E+04   100.0
```

```
SAMPLE: 88-268-03B     0.15 - 0.30

NUMBER     1  DISK   162    FILE 410 - 414  PARTICLES                          RUN/T   98.00

RUN        1  DATE  5/16/88  SUMMARY   413   TOTAL   551    MASS 2.4E+00  UG/CM2  ANAL./T 91.00

BLOCKS    29  TIME 14:34     OFF-PT.        > 50U     22    > 50U 2.9E+00  UG/CM2  DEAD/T   7.00

                                  WEIGHT DISTRIBUTION

          TYPE          0.2-1   1-2.5   2.5-5   5-10   10-20    +20   TOTAL

           KAOLINITE        1      11      23     43      11     11     9.0

           ILLITE...        3      34      28     23      12      0     1.8

           PYRITE...        0       0       3     19      14     64    67.9

           FE-SUL...        0       0       3     12      11     75     5.6

           MIXSIL...        3      10      19     19       5     44     6.0

           NOT-INT..        2      45      28     13       7      6     5.3

           MISC.....       13      23      36     17       8      4     4.3

           TOTAL....        1       6       9     20      12     52   100.0



                                AVERAGE COMPOSITION
  TYPE           AVE      NA    MG    AL    SI     S    CL     P     K    CA    TI    FE    WT%
QUARTZ...       6.00       0                94     3     1           1           0     1    0.4
KAOLINITE       2.58       1          40    48     2     2           2     2     2     3    9.0
ILLITE...       1.89       0          30    46     6     1          10     2     2     4    1.8
PYJAR....       2.78             1           7    58     4           3           5    22    0.1
PYRITE...       8.39             1     1     1    62                 1     1     1    34   67.9
HALITE...       4.53       9           8     2          75                 2     4     3    0.1
MONTMORIL       3.49       0     0    19    69     5     1           1     2     2     2    0.2
FE-SUL...       9.91             0     1     2    50                 1     1     1    45    5.6
QUARORG..       0.49                  27    45    13     2     0     4     1     5     3    1.5
QUARPYR..       0.50       0          33    32    12    11           1     0     1     8    0.5
MIXSIL...       1.38       1          32    52     4     2           2     2     3     3    6.0
UNKCHLOR.       5.91       9           7     2          75           2     4           1    0.4
NOT-INT..       1.45       2     2    41    30     8     5     3     3     2     6     6    5.3
UNKNOWN..       0.42       1          21    30    15    10     1     8     4     8     3    1.1
```

```
SAMPLE: 88-268-038       0.15 - 0.30 m

NUMBER    1  DISK   162     FILE 410 - 414  PARTICLES                            RUN/T   98.00

RUN       1  DATE  5/16/88  SUMMARY   413   TOTAL   551     MASS 2.4E+00  UG/CM2  ANAL./T 91.00

BLOCKS   29  TIME 14:34     OFF-PT.         ) 50U     22    ) 50U 2.9E+00  UG/CM2  DEAD/T   7.00

TABLE USED TO SCALE DATA

                   RUN PARAMETER TABLE
  MAG    BIN     XL      XU      PARTS  FIELDS  SCALE     MASS

  500     0     0.2     1.0        38   20.00      35  2.27E-02

  500     1     1.0     2.5       135   20.00      35  1.34E-01

  150     2     2.5     5.0       133    5.06      12  2.15E-01

  150     3     5.0    10.0        67    5.06      12  4.71E-01

   50     4    10.0    20.0       101    7.04       1  2.89E-01

   50     5    20.0    50.0        77    7.04       1  1.21E+00



                              SIZE DISTRIBUTION

   TYPE          0.2-1   1-2.5   2.5-5   5-10    10-20    +20      PART/CM2   %TOTAL
    QUARTZ...       0       0      46      46       7       0      1.1E+02      0.1
    KAOLINITE      29      39      18      13       1       0      9.3E+03      7.8
    ILLITE...      23      60      12       4       0       0      4.1E+03      3.4
    PYJAR....       0       0     100       0       0       0      6.4E+01      0.1
    PYRITE...       0       5      32      46       9       8      2.9E+03      2.5
    HALITE...       0       0     100       0       0       0      1.1E+02      0.1
    MONTMORIL       0       0     100       0       0       0      1.7E+02      0.1
    FE-SUL...       0       0      47      31       9      13      3.5E+02      0.3
    QUARORG..      90       8       2       0       0       0      3.1E+04     26.6
    QUARPYR..      93       5       2       0       0       0      1.0E+04      8.4
    MIXSIL...      71      14      11       3       0       0      1.0E+04      8.9
    UNKCHLOR.       0       0      34      64       3       0      1.7E+02      0.1
    NOT-INT..      31      60       8       1       0       0      1.9E+04     16.7
    UNKNOWN..      95       4       1       0       0       0      2.9E+04     24.7

    TOTAL....      70      20       6       3       0       0      1.1E+05    100.0
```

```
SAMPLE: 88-268-03C      0.30 - 0.45 m

NUMBER     1  DISK   162    FILE 415 - 419  PARTICLES                        RUN/T    91.00

RUN        1  DATE  5/17/88  SUMMARY   418   TOTAL   510    MASS 1.9E+00  UG/CM2  ANAL./T  78.99

BLOCKS    27  TIME  8:40    OFF-PT.       > 50U    16    > 50U 1.0E+00  UG/CM2  DEAD/T   12.00

                                    WEIGHT DISTRIBUTION

          TYPE              0.2-1   1-2.5   2.5-5   5-10   10-20    +20   TOTAL

           KAOLINITE           1      11      26     48      12      2    12.5

           ILLITE...           6      26      33     25       5      5     2.5

           PYRITE...           0       0      11     14      18     58    58.5

           FE-SUL...           0       0       0      0       7     93    11.1

           MIXSIL...           2      19      26     18      17     18     6.8

           NOT-INT..           2      29      29     22       5     13     4.0

           MISC.....           4      22      29     25       4     15     4.5

           TOTAL....           1       5      15     18      14     47   100.0



                                       AVERAGE COMPOSITION
            TYPE          AVE      NA    MG    AL    SI     S    CL     P     K    CA    TI    FE    WT%
           QUARTZ...     2.45       0     1     0    92     3     1           1     0     0     2    0.8
           KAOLINITE     2.45                  43    49     2     1           1     2     2     2   12.5
           ILLITE...     1.93                  33    49     3     2           9     1     1     2    2.5
           PYJAR....     3.80       0           3     1    65                 3     0     2    26    0.3
           PYRITE...     6.63       0     0     2     2    62                 1     1     2    34   58.5
           CALCITE..    23.73                   2           1     1           1    94           1    0.2
           RUTILE...     1.27             2     2     5    12           1     3          75          0.0
           MONTMORIL     1.85       1          19    68     4     2           1     3     1     3    0.2
           FE-SUL...    27.85       0     1     2     2    51     0           0     0     1    44   11.1
           QUARORG..     0.87       0          58    15    15     5           2     0     2     2    1.5
           QUARPYR..     1.53       1          49    20    14     4     1     1     2     2     8    0.8
           MIXSIL...     2.00       1          37    52     3     1           3     2     2     3    6.8
           NOT-INT..     0.95       1     2    36    28    12     7     1     7     8     2     3    4.0
           UNKNOWN..     2.77       0          84     3     1     3     2     2     1     2     3    0.7
```

```
SAMPLE: 88-268-03C        0.30 - 0.45 m

NUMBER     1  DISK   162     FILE 415 - 419  PARTICLES                              RUN/T   91.00

RUN        1  DATE  5/17/88  SUMMARY   418   TOTAL   510     MASS 1.9E+00  UG/CM2   ANAL./T 78.99

BLOCKS    27  TIME  8:40     OFF-PT.       ) 50U     16    ) 50U 1.0E+00  UG/CM2   DEAD/T  12.00

TABLE USED TO SCALE DATA

                    RUN PARAMETER TABLE
  MAG     BIN     XL      XU      PARTS  FIELDS  SCALE     MASS

  500      0      0.2     1.0       24   20.00      37  1.42E-02

  500      1      1.0     2.5      102   20.00      37  1.05E-01

  150      2      2.5     5.0      145    4.60      14  2.79E-01

  150      3      5.0    10.0       55    4.60      14  3.41E-01

   50      4     10.0    20.0      111    7.54       1  2.72E-01

   50      5     20.0    50.0       73    7.54       1  8.99E-01



                                 SIZE DISTRIBUTION

  TYPE              0.2-1   1-2.5   2.5-5   5-10    10-20    +20      PART/CM2  %TOTAL
   QUARTZ...          0       67      32      0        1       0      9.9E+02     1.7
   KAOLINITE         35       32      20     11        1       0      1.2E+04    20.9
   ILLITE...         42       38      16      4        0       0      4.5E+03     7.6
   PYJAR....          0        0     100      0        0       0      1.2E+02     0.2
   PYRITE...          0        0      61     27        8       5      3.3E+03     5.7
   CALCITE..          0        0       0      0        0     100      4.5E+00     0.0
   RUTILE...          0      100       0      0        0       0      1.8E+02     0.3
   MONTMORIL          0       63      37      0        0       0      4.3E+02     0.7
   FE-SUL...          0        0       0      0       28      72      1.2E+02     0.2
   QUARORG..         82       11       4      3        0       0      8.1E+03    13.7
   QUARPYR..         45       46       9      0        0       0      1.6E+03     2.8
   MIXSIL...         33       44      20      3        1       0      8.4E+03    14.2
   NOT-INT..         63       30       6      1        0       0      1.8E+04    30.7
   UNKNOWN..          0       65      18     17        0       0      7.0E+02     1.2

   TOTAL....         47       31      16      6        1       1      5.9E+04   100.0
```

```
SAMPLE: 88-268-03 COMP.    0.45 - 1.52 m

NUMBER    1 DISK  163    FILE 444 - 448  PARTICLES                                RUN/T  219.00

RUN       1 DATE  5/19/88  SUMMARY  447  TOTAL  493   MASS 2.4E+00  UG/CM2   ANAL./T106.00

BLOCKS   26 TIME 11:19    OFF-PT.        ) 50U    10   ) 50U 9.2E-01  UG/CM2   DEAD/T 112.99

                                  WEIGHT DISTRIBUTION

          TYPE          .2-1.  1.-2.5  2.5-5.  5.-10  10-20   +20    TOTAL

          KAOLINITE        1      4      43     19     33      0      3.1

          ILLITE...        7     19      11     26     37      0      2.3

          PYJAR....        4     17       7     38     34      0      3.0

          PYRITE...        0      2       7     11     30     50     71.6

          FE-SUL...        0      0       0      0     16     84      5.2

          QUARPYR..        2     11      10     21      5     51      4.0

          MIXSIL...        1      7       5     29     24     34      3.7

          NOT-INT..        1     19      23     13     29     14      3.5

          MISC.....        3      8       6      4     28     51      3.7

          TOTAL....        1      4       9     12     28     46    100.0



                                  AVERAGE COMPOSITION
   TYPE          AVE     NA   MG   AL   SI    S   CL    P    K   CA   TI   FE     WT%
 QUARTZ...      5.80     0             96     2    1         1              1     0.1
 KAOLINITE      3.10     0    0   41   48     4    1         2    1    1    2     3.1
 ILLITE...      0.83     0        26   46     8    2        11    1    3    3     2.3
 ORGSULF..      0.70     2    2    3    7    63    2         2    2    2   15     0.1
 PYJAR....      1.32     0    0    9    4    55    1         4    1    1   25     3.0
 PYRITE...      4.92     0    0    2    2    61              0    1    1   34    71.6
 SIDERITE.     38.67          1    1    7     9              2         4   75     1.2
 CALCITE..     15.66          2    2    5          2    1    2   74    3    9     0.4
 ANKERITE.     15.81          4    2          3         1    2   66        23     0.1
 FE-SUL...     23.89          1    2    2    46              1    1    1   49     5.2
 QUARORG..      0.83     1    0   60   16    13    2    0    2    1    1    3     1.0
 QUARPYR..      1.10     1    0   17   17    40    1    0    2    4    1   19     4.0
 MIXSIL...      2.52     0        38   44     4    2         6    2    2    2     3.7
 NOT-INT..      1.75     1    1   26   28    16    3    2    7    3    4   13     3.5
 UNKNOWN..      3.29     1    0   64    9     5    2    0    6    2    2    8     0.7
```

```
SAMPLE: 88-268-03 COMP.     0.45 - 1.52 m

NUMBER     1  DISK   163    FILE 444 - 448  PARTICLES                               RUN/T  219.00

RUN        1  DATE  5/19/88  SUMMARY   447   TOTAL   493     MASS 2.4E+00  UG/CM2   ANAL./T106.00

BLOCKS    26  TIME 11:19    OFF-PT.        ) 50U     10    ) 50U 9.2E-01  UG/CM2   DEAD/T 112.99

TABLE USED TO SCALE DATA

                 RUN PARAMETER TABLE
  MAG    BIN     XL      XU     PARTS  FIELDS  SCALE    MASS

  500     0     0.2     1.0       24   20.00     18  1.60E-02

  500     1     1.0     2.5       79   20.00     18  1.01E-01

  150     2     2.5     5.0      139    7.36      4  1.99E-01

  150     3     5.0    10.0       61    7.36      4  2.89E-01

   50     4    10.0    20.0      134    3.75      1  6.61E-01

   50     5    20.0    50.0       56    3.75      1  1.07E+00



                              SIZE DISTRIBUTION

  TYPE          .2-1.  1.-2.5   2.5-5.   5.-10   10-20    +20      PART/CM2   %TOTAL
 QUARTZ...        0       0       77       0      23       0       4.9E+01     0.1
 KAOLINITE       25      19       46       7       2       0       2.5E+03     4.7
 ILLITE...       84      11        3       1       0       0       1.2E+04    23.4
 ORGSULF..       98       0        2       0       0       0       1.9E+03     3.6
 PYJAR....       64      26        4       6       1       0       5.0E+03     9.4
 PYRITE...       10      37       27      12       9       4       7.9E+03    14.6
 SIDERITE.        0       0        0       0       0     100       8.7E+00     0.0
 CALCITE..        0       0        0       0      55      45       1.8E+01     0.0
 ANKERITE.        0       0        0       0     100       0       8.7E+00     0.0
 FE-SUL...        0       0        0       0      38      62       1.0E+02     0.2
 QUARORG..       85      11        3       0       1       0       5.5E+03    10.2
 QUARPYR..       71      21        5       3       0       0       8.6E+03    15.8
 MIXSIL...       41      40        8       9       2       1       2.5E+03     4.8
 NOT-INT..       32      54       11       2       2       0       6.7E+03    12.4
 UNKNOWN..        0      77       10       9       2       2       4.0E+02     0.7

 TOTAL....       58      25       10       4       2       1       5.4E+04   100.0
```

```
SAMPLE: 88-268-03M          1.53 - 1.68 m

NUMBER     1  DISK   162    FILE 420 - 424  PARTICLES                        RUN/T  107.99

RUN        1  DATE  5/17/88  SUMMARY   423  TOTAL   502    MASS 8.7E+00  UG/CM2  ANAL./T101.99

BLOCKS    26  TIME 10:16    OFF-PT.       > 50U     4    > 50U 2.4E+00  UG/CM2  DEAD/T   6.00

                          WEIGHT DISTRIBUTION

TYPE           0.2-1   1-2.5   2.5-5    5-10   10-20     +20   TOTAL

 KAOLINITE         0       2      26      65       7       0     3.7

 ILLITE...         0       0      33      67       0       0     1.5

 PYJAR....         1       7      30      17      45       0     2.0

 PYRITE...         0       2       7      19      34      38    77.3

 FE-SUL...         0       0       1       2      13      84     6.0

 QUARORG..         1       2      47      49       0       0     1.8

 QUARPYR..         0       3      14      52      11      19     1.5

 MIXSIL...         0       1      35      63       0       0     1.9

 NOT-INT..         1       4      29      34      24       8     2.5

 MISC.....         0       1      14      54       0      30     1.7

 TOTAL....         0       2      10      23      29      36   100.0


                            AVERAGE COMPOSITION
  TYPE           AVE   NA   MG   AL   SI    S   CL    P    K   CA   TI   FE   WT%
QUARTZ...       5.50    0    0        93    2    1         1    0    2    0   1.1
KAOLINITE       4.57    1        39   47    6    2         2    2    2    3   3.7
ILLITE...       4.53    0    0   29   47    7    3         9    2    2    4   1.5
PYJAR....       2.71    1    0    2    4   60    0         3    2    2   26   2.0
PYRITE...       5.36    0         2    1   63                   0    1   32  77.3
SIDERITE.       2.40         1             27    2         2    3        62   0.0
FE-SUL...      12.26    1    0    3    3   47              0    1    1   46   6.0
QUARORG..       2.38    2        29   33   20    0         7    2    2    4   1.8
QUARPYR..       4.30    1    1   15   26   31    2    0    3    2    3   16   1.5
MIXSIL...       4.56    0        30   54    6    1         2    2    2    3   1.9
NOT-INT..       2.23    1    0   37   27   16    4    0    4    3    2    7   2.5
UNKNOWN..       4.04    1        48   16    9    2         2    5    9    8   0.6
```

```
SAMPLE: 88-268-03M     1.53 - 1.68 m

NUMBER      1  DISK   162     FILE 420 - 424  PARTICLES                                   RUN/T  107.99

RUN         1  DATE  5/17/88  SUMMARY    423   TOTAL    502     MASS 8.7E+00  UG/CM2   ANAL./T101.99

BLOCKS     26  TIME 10:16     OFF-PT.         ) 50U       4   ) 50U 2.4E+00  UG/CM2   DEAD/T    6.00

TABLE USED TO SCALE DATA

                          RUN PARAMETER TABLE
    MAG     BIN     XL       XU       PARTS  FIELDS   SCALE      MASS

    500      0      0.2      1.0        14   20.00        6  1.20E-02

    500      1      1.0      2.5        92   20.00        6  1.50E-01

    150      2      2.5      5.0       116    1.31        8  8.72E-01

    150      3      5.0     10.0        84    1.31        8  1.97E+00

     50      4     10.0     20.0       149    1.27        1  2.46E+00

     50      5     20.0     50.0        47    1.27        1  3.05E+00




                                SIZE DISTRIBUTION

     TYPE                0.2-1   1-2.5   2.5-5   5-10    10-20    +20      PART/CM2   %TOTAL
      QUARTZ...            0       0      62      36       0       2      1.1E+03     1.5
      KAOLINITE            0      15      49      35       1       0      7.2E+03     9.2
      ILLITE...            0       0      63      37       0       0      3.4E+03     4.4
      PYJAR....           22      35      33       5       4       0      4.6E+03     5.9
      PYRITE...            8      28      26      25      10       3      3.1E+04    40.7
      SIDERITE.            0     100       0       0       0       0      1.5E+02     0.2
      FE-SUL...            0      16      23      23      15      23      9.4E+02     1.2
      QUARORG..           47       7      32      14       0       0      9.2E+03    11.8
      QUARPYR..            0      34      31      31       2       1      2.6E+03     3.4
      MIXSIL...           10       4      51      35       0       0      4.1E+03     5.3
      NOT-INT..           49      14      27       9       2       0      1.1E+04    14.6
      UNKNOWN..           37       0      32      32       0       0      1.3E+03     1.7

      TOTAL....           18      20      33      23       5       1      7.8E+04   100.0
```

```
SAMPLE: 88-268-03N    1.68 - 1.83 m

NUMBER     1  DISK   162    FILE 425 - 429  PARTICLES                          RUN/T  101.00

RUN        1  DATE  5/17/88  SUMMARY   428   TOTAL   526    MASS 6.6E+00  UG/CM2  ANAL./T 89.00

BLOCKS    27  TIME 14: 8    OFF-PT.        > 50U     7    > 50U 4.5E+00  UG/CM2  DEAD/T  12.00

                                     WEIGHT DISTRIBUTION

              TYPE          0.2-1   1-2.5   2.5-5   5-10    10-20    +20   TOTAL

               KAOLINITE       1      15      41      22      20      0     1.8

               PYRITE...       0       1       6      11      31     51    79.6

               FE-SUL...       0       0       0       2      26     72     7.4

               NOT-INT..       1       7       6       0      65     22     1.8

               MISC.....       2      10      18      12      15     44     9.4

               TOTAL....       0       2       8      10      30     50   100.0



                                        AVERAGE COMPOSITION
               TYPE           AVE    NA    MG    AL    SI     S    CL     P     K    CA    TI    FE    WT%
              QUARTZ...      3.20     0     0     2    92     3     1           1     0     0     2    0.7
              KAOLINITE      2.53     1          39    47     6     2     1     2     1     1     3    1.8
              ILLITE...      2.60     1          31    45     7     2           9     2     2     4    1.0
              PYJAR....      1.17           0     2     6    58     5           3     2     1    23    0.7
              PYRITE...      6.11     0     0     3     2    62                 0     0     1    32   79.6
              SIDERITE.     20.64                 4     1    14     1           1     1     2    77    0.7
              CALCITE..      6.60           2     1     2     2     2     1     1    81     0     6    0.9
              ANKERITE.     40.42           4    11     5     7                      47     2    23    1.2
              MONTMORIL     15.81     1          15    80     2     1           1                      0.1
              FE-SUL...     17.11     0     0     4     2    47                 0     1     1    46    7.4
              QUARORG..      0.78     1     1    26    37    20     5     0     4     1     1     4    0.6
              QUARPYR..      1.18     1     1    26    34    20     4           1     1     2    10    0.8
              MIXSIL...      3.12     0          34    50     4     2           3     2     3     3    1.4
              MIXSUL...      4.04     2     1     5     4    46     6           2    26     1    10    0.2
              NOT-INT..      2.27     2     1    31    26    12     4     3     4     3     3    13    1.8
              UNKNOWN..      0.87     1          26    10    12     2           3     4     1    42    1.1
```

```
SAMPLE: 88-268-03N     1.68 - 1.83 m

NUMBER     1  DISK   162     FILE 425 - 429  PARTICLES                          RUN/T  101.00

RUN        1  DATE  5/17/88  SUMMARY   428   TOTAL   526     MASS 6.6E+00  UG/CM2   ANAL./T 89.00

BLOCKS    27  TIME 14: 8     OFF-PT.        ) 50U      7    ) 50U 4.5E+00  UG/CM2   DEAD/T  12.00

TABLE USED TO SCALE DATA

                    RUN PARAMETER TABLE
   MAG     BIN     XL      XU     PARTS  FIELDS  SCALE    MASS

   500      0      0.2     1.0      22   20.00       7  1.49E-02

   500      1      1.0     2.5     111   20.00       7  1.34E-01

   150      2      2.5     5.0     144    3.28       4  4.93E-01

   150      3      5.0    10.0      56    3.28       4  6.44E-01

    50      4     10.0    20.0     135    1.52       1  1.91E+00

    50      5     20.0    50.0      58    1.52       1  3.23E+00



                                    SIZE DISTRIBUTION

    TYPE             0.2-1   1-2.5   2.5-5   5-10    10-20    +20      PART/CM2  %TOTAL
     QUARTZ...         0      64      28       0       6       2       9.1E+02     1.3
     KAOLINITE        24      41      29       6       1       0       6.0E+03     8.3
     ILLITE...        22      36      31      11       0       0       3.8E+03     5.4
     PYJAR....        59      23      19       0       0       0       5.7E+03     7.8
     PYRITE...         8      21      36      18      12       5       1.7E+04    23.6
     SIDERITE.         0       0       0       0      50      50       4.0E+01     0.1
     CALCITE..         0      79       0       0      10      10       1.9E+02     0.3
     ANKERITE.         0       0       0       0       0     100       2.0E+01     0.0
     MONTMORIL         0       0       0       0     100       0       2.0E+01     0.0
     FE-SUL...         0       0       0      28      48      24       5.9E+02     0.8
     QUARORG..        75      23       2       0       0       0       2.0E+04    27.6
     QUARPYR..        74      16       9       1       0       0       6.1E+03     8.4
     MIXSIL...         0      74       6      16       3       1       2.6E+03     3.7
     MIXSUL...         0       0      60      40       0       0       4.2E+02     0.6
     NOT-INT..        20      64      10       0       5       1       3.5E+03     4.9
     UNKNOWN..        83      10       7       0       1       0       5.2E+03     7.2

     TOTAL....        44      27      17       7       4       2       7.2E+04   100.0
```

```
SAMPLE: 88-268-030        1.83 - 1.98 m

NUMBER     1  DISK   163     FILE 430 - 434  PARTICLES                          RUN/T  197.00

RUN        1  DATE  5/18/88  SUMMARY   433   TOTAL   595     MASS 6.3E+00  UG/CM2  ANAL./T189.00

BLOCKS    30  TIME  8:42     OFF-PT.        > 50U      5    > 50U 2.0E+00  UG/CM2  DEAD/T   8.00

                                          WEIGHT DISTRIBUTION

              TYPE            0.2-1   1-2.5   2.5-5   5-10    10-20    +20   TOTAL

               QUARTZ...         0       1      27     65       6       0     4.0

               KAOLINITE         0       2      34     54       6       4    12.4

               ILLITE...         2      13      49     27       4       5     5.5

               PYJAR....         0       3      49     38       3       7     5.3

               PYRITE...         0       2      23     32      27      16    53.0

               FE-SUL...         0       1       0      0      40      59     1.8

               QUARORG..        11      20      43     24       1       0     3.1

               QUARPYR..         4      15      31     12      13      25     3.1

               MIXSIL...         1       4      36     34      15      11     7.7

               NOT-INT..         3      52      31      0       6       9     1.7

               MISC.....         2       5      20      9      16      48     2.5

               TOTAL....         1       5      29     34      18      14   100.0


                                           AVERAGE COMPOSITION
               TYPE          AVE      NA    MG    AL    SI     S     CL     P     K    CA    TI    FE    WT%
              QUARTZ...      4.52      1     1     1    90     3     2            2     1     1     0    4.0
              KAOLINITE      2.83      0          39    48     5     1            1     2     2     2   12.4
              ILLITE...      1.82      0          25    48     9     1           10     2     2     3    5.5
              ORGSULF..      1.52            1     1          69     2            4     1     3    19    0.0
              PYJAR....      3.06      1     1     2     6    58     0            3     2     3    25    5.3
              PYRITE...      4.59            1     2     2    63                  1     1     1    32   53.0
              HALITE...     28.48     14           1     2          78     0      1     1     0     1    1.3
              CALCITE..     12.45      0     4     1     2     3     1     2      1    75     2     9    0.3
              MONTMORIL      4.35      1          14    73     5     0            3     1     1     2    0.6
              FE-SUL...      7.92      0     0     2     3    52                  0     0     1    42    1.8
              QUARORG..      0.50      1          28    36    19     2     0      6     2     2     4    3.1
              QUARPYR..      1.11      0     0    22    36    22     1            4     1     4    11    3.1
              MIXSIL...      0.99                 20    54     8     1           11     0     2     3    7.7
              MIXSUL...      1.70      2           7    15    54                  7           3    13    0.1
              NOT-INT..      1.28      1     3    25    34    17     3     1      4     3     2     8    1.7
              UNKNOWN..      0.88      1          36    26     8     1            4     4    16     5    0.2
```

```
SAMPLE: 88-268-030     1.83 - 1.98 m

NUMBER      1  DISK   163    FILE 430 - 434  PARTICLES                              RUN/T  197.00

RUN         1  DATE  5/18/88  SUMMARY   433   TOTAL   595     MASS 6.3E+00  UG/CM2  ANAL./T189.00

BLOCKS     30  TIME  8:42    OFF-PT.        ) 50U      5    ) 50U 2.0E+00  UG/CM2  DEAD/T   8.00

TABLE USED TO SCALE DATA

                      RUN PARAMETER TABLE
    MAG    BIN     XL      XU      PARTS  FIELDS  SCALE     MASS

    500     0     0.2     1.0        46   11.41      23  4.88E-02

    500     1     1.0     2.5       154   11.41      23  2.80E-01

    150     2     2.5     5.0       149    0.75      32  1.78E+00

    150     3     5.0    10.0        51    0.75      32  2.09E+00

     50     4    10.0    20.0       156    2.70       1  1.12E+00

     50     5    20.0    50.0        39    2.70       1  8.48E-01



                                  SIZE DISTRIBUTION

   TYPE             0.2-1   1-2.5   2.5-5   5-10    10-20    +20      PART/CM2   %TOTAL
    QUARTZ...          0      11      47      41       1       0       5.4E+03     1.6
    KAOLINITE         42      10      31      17       1       0       2.8E+04     8.4
    ILLITE...         47      24      25       4       0       0       3.0E+04     8.7
    ORGSULF..          0     100       0       0       0       0       2.7E+02     0.1
    PYJAR....         10      19      60      12       0       0       9.4E+03     2.7
    PYRITE...          0      17      56      22       4       1       2.6E+04     7.8
    HALITE...          0       0       0       0      55      45       5.0E+01     0.0
    CALCITE..          0       0       0       0     100       0       5.1E+01     0.0
    MONTMORIL          0       0      68      32       0       0       1.1E+03     0.3
    FE-SUL...          0      65       0       0      22      14       4.1E+02     0.1
    QUARORG..         90       6       3       0       0       0       1.2E+05    34.9
    QUARPYR..         72      14      11       3       0       0       2.8E+04     8.2
    MIXSIL...         79       4      13       4       0       0       6.1E+04    18.0
    MIXSUL...          0     100       0       0       0       0       5.4E+02     0.2
    NOT-INT..         29      63       8       0       0       0       2.5E+04     7.3
    UNKNOWN..         84      10       7       0       0       0       5.6E+03     1.6

    TOTAL....         63      14      17       5       1       0       3.4E+05   100.0
```

3. Harbour Seam - Lingan Mine

Shale Roof

```
SAMPLE: 88-268-01A     0.00 - 0.15m

NUMBER     1  DISK   157    FILE 274 - 278  PARTICLES                           RUN/T  216.00

RUN        1  DATE  4/20/88  SUMMARY   277   TOTAL    505     MASS 4.4E+00  UG/CM2   ANAL./T168.00

BLOCKS    27  TIME  8: 9     OFF-PT.         ) 50U     21    ) 50U 5.2E+00  UG/CM2   DEAD/T  47.99

                                  WEIGHT DISTRIBUTION

               TYPE          0.2-1   1-2.5   2.5-5   5-10    10-20    +20   TOTAL

                QUARTZ...       0       1      25      23      30      22     1.8

                KAOLINITE       0       4      13      35      10      38    13.6

                PYRITE...       0       0       4       5      22      69    34.4

                FE-SUL...       0       0       0       3       0      97     7.3

                QUARPYR..       4      10       5       0      13      69     1.8

                MIXSIL...       0       2       6      16      22      53     8.8

                APATITE..       0       0       7      15      54      24    11.0

                NOT-INT..       1       5       3       5       5      81    13.8

                UNKNOWN..       0       3      14      16      40      27     4.2

                MISC.....       2      17      17       3      25      37     3.2

                TOTAL....       0       2       7      12      21      58   100.0



                                    AVERAGE COMPOSITION
                 TYPE          AVE     NA    MG    AL    SI     S    CL     P     K    CA    TI    FE   WT%
                QUARTZ...     4.78      0     0     1    93     2     1                 1     2     2   1.8
                KAOLINITE     4.49      1          42    48     3     2           1     3     2     2  13.6
                ILLITE...     2.92      1          33    46     2     3           8     2     1     4   1.0
                PYJAR....     2.50      1     0     8     5    55     1           4     1          25   0.3
                PYRITE...     8.39            1     2     3    63                 1     2     1    30  34.4
                CALCITE..     3.21      1           4     3                15          76     2         0.0
                FE-SUL...    24.43            0     2     3    46     0           1     1     2    46   7.3
                QUARORG..     1.68      1     0    34    35    15     2     0     2     4     3     4   1.2
                QUARPYR..     0.38      0          36    20    27     0           1     0     1    15   1.8
                MIXSIL...     2.46      1          38    47     4     2           3     3     2     3   8.8
                MIXSUL...    39.99            2     2     3    46                 2     6          39   0.7
                APATITE..     8.14            1     1                 0    24     1    70     1     1  11.0
                NOT-INT..     0.94      3     2    36    16    29     5     2     3     6    10     5  13.8
                UNKNOWN..     0.90      2          34    24     7     2     6     0    16     9     1   4.2
```

```
SAMPLE: 88-268-01A      0.00  - 0.15 m

NUMBER     1  DISK   157    FILE 274 - 278  PARTICLES                                  RUN/T  216.00

RUN        1  DATE  4/20/88  SUMMARY   277   TOTAL   505    MASS 4.4E+00  UG/CM2  ANAL./T168.00

BLOCKS    27  TIME  8: 9    OFF-PT.        ) 50U     21    ) 50U 5.2E+00  UG/CM2  DEAD/T  47.99

TABLE USED TO SCALE DATA

                  RUN PARAMETER TABLE
  MAG    BIN     XL      XU     PARTS  FIELDS  SCALE    MASS

  500     0     0.2     1.0       23   20.00       9  1.37E-02

  500     1     1.0     2.5      103   20.00       9  1.07E-01

  150     2     2.5     5.0      126    3.73       4  2.80E-01

  150     3     5.0    10.0       74    3.73       4  5.00E-01

   50     4    10.0    20.0      112    1.81       1  8.95E-01

   50     5    20.0    50.0       67    1.81       1  2.51E+00



                                    SIZE DISTRIBUTION

  TYPE            0.2-1   1-2.5   2.5-5   5-10    10-20    +20     PART/CM2   %TOTAL
   QUARTZ...         0      14      61      20       5       2     1.1E+03      1.0
   KAOLINITE         4      33      33      26       2       1     9.3E+03      8.0
   ILLITE...        34      36      17       6       7       0     1.2E+03      1.1
   PYJAR....         0      67      33       0       0       0     6.9E+02      0.6
   PYRITE...         0      18      41      15      15      11     2.5E+03      2.2
   CALCITE..         0       0     100       0       0       0     7.4E+01      0.1
   FE-SUL...         0       0       0      38       0      62     1.9E+02      0.2
   QUARORG..        46      45       9       0       1       0     4.1E+03      3.5
   QUARPYR..        95       4       0       0       0       0     3.2E+04     28.2
   MIXSIL...        53      19      16       9       2       1     7.6E+03      6.5
   MIXSUL...         0       0       0       0       0     100     1.7E+01      0.0
   APATITE..         0       0      37      30      29       3     2.9E+03      2.5
   NOT-INT..        78      18       2       1       0       1     3.7E+04     32.1
   UNKNOWN..        80      11       6       2       1       0     1.6E+04     14.1

   TOTAL....        69      15       8       5       2       1     1.1E+05    100.0
```

```
SAMPLE: 88-268-01B    0.15 - 0.30 m

NUMBER     1  DISK   157    FILE 290 - 293  PARTICLES                          RUN/T   93.00

RUN        1  DATE  4/21/88  SUMMARY   292  TOTAL   382    MASS 2.2E+00  UG/CM2  ANAL./T 68.00

BLOCKS    21  TIME  8:25     OFF-PT.        ) 50U    30    ) 50U 2.4E+00  UG/CM2  DEAD/T  24.99

                                  WEIGHT DISTRIBUTION

            TYPE           .2-1.  1.-2.5  2.5-5.   5.-10   10-20     +20   TOTAL

            QUARTZ...          0       0      30      66       3       0     2.1

            KAOLINITE          0       1      11      36      37      14    12.8

            PYRITE...          0       0       3       2       6      88    62.2

            FE-SUL...          0       0       0       0       6      94    10.9

            MIXSIL...          0       1       9      11      20      59     7.8

            NOT-INT..          0       1      32      37      20      10     2.4

            MISC.....          2       5      62      26       5       0     1.7

            TOTAL....          0       0       7       9      12      72   100.0



                                   AVERAGE COMPOSITION
            TYPE             AVE    NA    MG    AL    SI     S    CL     P     K    CA    TI    FE     WT%
            QUARTZ...       4.86     0     0          94     2     1           2     0     1     1     2.1
            KAOLINITE       5.66                44    49     2     2           1     1     1     2    12.8
            ILLITE...       0.50                37    43     8     2           8     0     0     2     0.5
            PYJAR....       2.92                       1    69                 4           1    26     0.0
            PYRITE...       7.26     1     1     1     2    62                 1           1    34    62.2
            SIDERITE.       4.83                10     5    12                                  73     0.1
            CALCITE..       1.75                 4                       1          91     1     3     0.0
            FE-SUL...      30.64     0     0     1     2    48                 0     1     1    48    10.9
            QUARORG..       2.17     1     0    78     9     6     2           2     1     2     0     0.3
            QUARPYR..       3.68     1     0    57    15    10     4           2     2     2     7     0.2
            MIXSIL...       6.32     0          44    48     1     1           2     1     2     2     7.8
            NOT-INT..       3.98     2     3    36    27     8     2     1     6     4     5    10     2.4
            UNKNOWN..       3.65     2          77     4     0     6     2     1     4     3     2     0.5
```

```
 SAMPLE:  88-268-01C  0.15 - 0.30 m

BLOCKS    21  TIME  8:25     OFF-PT.       ) 50U     30    ) 50U 2.4E+00  UG/CM2   DEAD/T  24.99

TABLE USED TO SCALE DATA

                         RUN PARAMETER TABLE
   MAG     BIN      XL      XU      PARTS  FIELDS  SCALE     MASS

   500      0      0.2     1.0        2   20.00      26  1.71E-03

   500      1      1.0     2.5       10   20.00      26  9.87E-03

   150      2      2.5     5.0      134    7.71       6  1.44E-01

   150      3      5.0    10.0       66    7.71       6  2.03E-01

    50      4     10.0    20.0       90    5.27       1  2.51E-01

    50      5     20.0    50.0       80    5.27       1  1.55E+00



                                 SIZE DISTRIBUTION

    TYPE           .2-1.  1.-2.5   2.5-5.   5.-10   10-20    +20      PART/CM2   %TOTAL
   QUARTZ...         0       0       62       37       1      0       8.8E+02     5.6
   KAOLINITE         0      16       36       36      10      1       3.5E+03    22.2
   ILLITE...        90       4        4        1       0      0       5.5E+03    35.2
   PYJAR....         0       0      100        0       0      0       3.6E+01     0.2
   PYRITE...        24      15       36        7       4     13       2.0E+03    12.7
   SIDERITE.         0       0      100        0       0      0       3.6E+01     0.2
   CALCITE..         0     100        0        0       0      0       1.7E+02     1.1
   FE-SUL...         0       0        0        0      21     79       1.1E+02     0.7
   QUARORG..         0      50       43        7       0      0       5.5E+02     3.5
   QUARPYR..         0       0       96        0       4      0       1.6E+02     1.0
   MIXSIL...         0      13       50       24       7      7       1.2E+03     7.7
   NOT-INT..         0      13       66       18       2      0       1.1E+03     7.5
   UNKNOWN..         0       0       90       10       0      0       3.6E+02     2.3

   TOTAL....        35      12       32       15       4      3       1.5E+04   100.0
```

```
SAMPLE: 88-268-01C     0.30 - 0.45 m

NUMBER     1  DISK   157     FILE 294 - 297  PARTICLES                        RUN/T  169.99

RUN        1  DATE  4/21/88  SUMMARY   296   TOTAL   436    MASS 1.0E+00  UG/CM2   ANAL./T148.00

BLOCKS    23  TIME 10:51     OFF-PT.       > 50U     12    > 50U 5.2E-01  UG/CM2   DEAD/T  21.99

                                     WEIGHT DISTRIBUTION

          TYPE           0.2-1   1-2.5   2.5-5   5-10    10-20    +20   TOTAL

           KAOLINITE       1       1       6      16      30      46    18.9

           PYRITE...       0       0       1       1      13      84    51.9

           FE-SUL...       0       0       0       0       5      95     5.6

           QUARORG..       4      39      40      12       6       0     1.5

           MIXSIL...       1       5       4      10      28      53    10.3

           NOT-INT..       7       3      31      29      26       4     5.0

           UNKNOWN..       0      38      30      26       7       0     2.5

           MISC.....       5      19      28      30      18       0     4.3

           TOTAL....       1       3       6       8      18      63   100.0



                                     AVERAGE COMPOSITION
             TYPE           AVE      NA    MG    AL    SI     S    CL     P     K    CA    TI    FE   WT%
           QUARTZ...       1.99      1     0          94     2     1           0     1           2   1.3
           KAOLINITE       3.95      0          44    48     2     1           1     1     2     1  18.9
           ILLITE...       2.56      1          30    42     5     2     0    14     2     2     2   1.2
           CHAMOSITE       0.88      2     0    22    28     6     1           1     2     2    36   0.2
           PYJAR....       3.75      2     1     4     2    59     1           2     1     3    26   0.2
           PYRITE...      14.96            0     1     1    62                 0           1    33  51.9
           SIDERITE.      14.06            1     3     5    23                       1     1    68   0.2
           CALCITE..       4.78            1     1     1     2     0           1    90     1     3   0.2
           FE-SUL...      28.16      0     1     1     2    52                 1     1     2    43   5.6
           QUARORG..       1.67      0          86     2     6     1     2     2     1     2         1.5
           QUARPYR..       1.32      1     0    71     8     6     2     1     4     2     1     4   1.0
           MIXSIL...       3.64      1          41    45     2     1           2     1     1     7  10.3
           NOT-INT..       0.48      1     2    46    14    16     4     1     6     4     3     6   5.0
           UNKNOWN..       2.29      1          83     3     2     2     4     2     4     2     4   2.5
```

```
SAMPLE: 88-268-01C     0.30 - 0.45 m

NUMBER      1  DISK   157     FILE 294 - 297  PARTICLES                                  RUN/T  169.99

RUN         1  DATE  4/21/88  SUMMARY   296   TOTAL    436     MASS 1.0E+00  UG/CM2   ANAL./T148.00

BLOCKS     23  TIME 10:51     OFF-PT.          ) 50U     12    ) 50U 5.2E-01  UG/CM2   DEAD/T  21.99

TABLE USED TO SCALE DATA

                         RUN PARAMETER TABLE
   MAG    BIN     XL      XU      PARTS  FIELDS  SCALE      MASS

   500     0     0.2     1.0        14   20.00      44  8.41E-03

   500     1     1.0     2.5        34   20.00      44  3.34E-02

   150     2     2.5     5.0       140   15.52       5  6.69E-02

   150     3     5.0    10.0        60   15.52       5  8.68E-02

    50     4    10.0    20.0       117    8.85       1  1.91E-01

    50     5    20.0    50.0        71    8.85       1  6.71E-01



                                       SIZE DISTRIBUTION

    TYPE           0.2-1   1-2.5   2.5-5   5-10   10-20   +20      PART/CM2   %TOTAL
     QUARTZ...       53      17      22      6      1      0        8.8E+02     2.3
     KAOLINITE       52       6      18     14      6      3        2.5E+03     6.7
     ILLITE...        0      63      28      9      0      0        7.7E+02     2.0
     CHAMOSITE       99       0       0      0      1      0        4.6E+02     1.2
     PYJAR....        0       0      70     30      0      0        5.9E+01     0.2
     PYRITE...        0       0      35     10     26     29        3.6E+02     1.0
     SIDERITE.        0       0       0      0    100      0        3.9E+00     0.0
     CALCITE..        0       0      91      0      9      0        3.9E+01     0.1
     FE-SUL...        0       0       0      0     20     80        3.5E+01     0.1
     QUARORG..       24      60      14      2      0      0        2.0E+03     5.3
     QUARPYR..       49      46       4      2      0      0        2.2E+03     6.0
     MIXSIL...       22      51      11      9      5      3        1.5E+03     4.0
     NOT-INT..       94       2       3      1      0      0        2.4E+04    65.4
     UNKNOWN..        0      78      15      6      1      0        2.1E+03     5.6

     TOTAL....       72      16       7      3      1      1        3.7E+04   100.0
```

```
SAMPLE: 88-268-01 COMP.  0.45 - 1.35 m

NUMBER     1  DISK   163     FILE 435 - 439  PARTICLES                          RUN/T  213.00

RUN        1  DATE  5/18/88  SUMMARY   438   TOTAL   599      MASS 1.4E+00  UG/CM2  ANAL./T206.99

BLOCKS    30  TIME 13:27     OFF-PT.       ) 50U      1     ) 50U 1.9E-02  UG/CM2  DEAD/T   6.00

                                    WEIGHT DISTRIBUTION

              TYPE         .2-1.  1.-2.5   2.5-5.   5.-10  10-20   +20   TOTAL

              QUARTZ...      0       8        7       25     15     45     9.7

              KAOLINITE      0       5       16       17     48     15     2.6

              CHAMOSITE      1       6       32       45     15      0    15.5

              PYRITE...      0       1        3        0     22     72    17.8

              QUARPYR..      8       3       14       26     13     36     1.8

              MIXSIL...      2       6       21       27     26     18    21.3

              NOT-INT..      3      49       25        4     10      8    16.8

              UNKNOWN..      3       6       26       28     21     15     7.7

              MISC.....      0       4       35       32     14     14     6.9

              TOTAL....      2      13       20       21     19     26   100.0



                                          AVERAGE COMPOSITION
               TYPE          AVE     NA    MG    AL    SI     S    CL     P     K    CA    TI    FE      WT%
              QUARTZ...     4.02      0     0     1    92     0     0           1     0     1     2      9.7
              KAOLINITE     4.83      0     0    40    48     2     1           2     2     2     4      2.6
              ILLITE...     3.51      1          29    46     6     1          11     2     2     4      0.8
              CHAMOSITE     2.94      0     1    18    30     4     1     0     0     2     2    44     15.5
              ORGSULF..     3.23      2     1     6     5    56     4           3    16           6      0.1
              JAROSITE.     7.46      2           2     4    33    17     1     2           2    36      0.6
              PYRITE...     4.27      0     0     2     2    63                 1     0     1    32     17.8
              HALITE...     2.53     17           4     3          64           1     4     4     3      0.4
              SIDERITE.    16.62            1     8    12     0     1     0     3     2     2    72      0.9
              CALCITE..    12.38                  1     3     1     2                91           3      0.1
              RUTILE...     2.05      1     1     1     2     1                 3     1    89     2      0.1
              MONTMORIL    14.50      2     0    12    70     3     0           3     4     2     3      0.4
              FE-SUL...     8.16            0     3     2    42     2           1           1    50      1.0
              QUARORG..     4.00      1          77     2    10     2     1     2     3     2     3      1.0
              QUARPYR..     0.50                 54    22    10     1           3     0     2     8      1.8
              MIXSIL...     0.84      0          24    40     3     2           6     2     2    21     21.3
              MIXSUL...     5.77      3     1    10     5    48     3           0    23     2     6      1.3
              UNKCHLOR.     5.12     13           6     6          58                13           5      0.3
              NOT-INT..     0.93      2     1    24    29     8     6     0     5     3     2    24     16.8
              UNKNOWN..     1.04      3     0    22    14    16    10     1     3     9     3    20      7.7
```

```
SAMPLE: 88-268-01 COMP.    0.45 - 1.35 m

NUMBER     1  DISK   163     FILE 435 - 439  PARTICLES                         RUN/T  213.00

RUN        1  DATE  5/18/88  SUMMARY   438   TOTAL    599    MASS 1.4E+00  UG/CM2   ANAL./T206.99

BLOCKS    30  TIME 13:27     OFF-PT.         > 50U      1    > 50U 1.9E-02  UG/CM2   DEAD/T    6.00

TABLE USED TO SCALE DATA

                     RUN PARAMETER TABLE
   MAG    BIN     XL      XU     PARTS  FIELDS  SCALE    MASS

   500     0     0.2     1.0      34   18.21     38  2.32E-02

   500     1     1.0     2.5     166   18.21     38  1.80E-01

   150     2     2.5     5.0     147    3.79     16  2.85E-01

   150     3     5.0    10.0      52    3.79     16  3.04E-01

    50     4    10.0    20.0     154    7.03      1  2.75E-01

    50     5    20.0    50.0      46    7.03      1  3.68E-01



                              SIZE DISTRIBUTION

   TYPE          .2-1.  1.-2.5   2.5-5.   5.-10   10-20     +20     PART/CM2   %TOTAL
  QUARTZ...        0      57       20      18       2        2      2.3E+03     1.6
  KAOLINITE        0      32       43      14      10        1      5.2E+02     0.4
  ILLITE...        0      32       68       0       0        0      5.3E+02     0.4
  CHAMOSITE       33      21       30      15       2        0      8.0E+03     5.4
  ORGSULF..        0       0      100       0       0        0      7.4E+01     0.0
  JAROSITE.        0       0        0     100       0        0      7.3E+01     0.0
  PYRITE...       29      42       16       0       6        6      9.0E+02     0.6
  HALITE...        0      63       37       0       0        0      3.9E+02     0.3
  SIDERITE.        0       0        0       0      52       48      1.8E+01     0.0
  CALCITE..        0       0        0       0     100        0      4.9E+00     0.0
  RUTILE...        0     100        0       0       0        0      1.7E+02     0.1
  MONTMORIL        0       0        0       0     100        0      1.6E+01     0.0
  FE-SUL...        0       0        0      89       5        5      8.2E+01     0.1
  QUARORG..        0       0       99       0       1        0      4.4E+02     0.3
  QUARPYR..       96       2        1       1       0        0      1.0E+04     6.8
  MIXSIL...       85       6        5       3       1        0      4.2E+04    28.0
  MIXSUL...        0       0       50      50       0        0      2.9E+02     0.2
  UNKCHLOR.        0       0       94       0       6        0      7.8E+01     0.1
  NOT-INT..       61      34        5       0       0        0      7.0E+04    46.8
  UNKNOWN..       79       8       10       3       1        0      1.3E+04     9.1

  TOTAL....       68      21        8       3       1        0      1.5E+05   100.0
```

```
SAMPLE: 88-268-01J          1.35 - 1.50 m

NUMBER     1  DISK   160    FILE 339 - 342  PARTICLES                          RUN/T  342.99

RUN        1  DATE  4/26/88  SUMMARY   341   TOTAL   467    MASS 4.5E-01  UG/CM2  ANAL./T285.99

BLOCKS    24  TIME 10:25    OFF-PT.       > 50U     5    > 50U 9.6E-02  UG/CM2  DEAD/T  57.00

                                 WEIGHT DISTRIBUTION

           TYPE        0.2-1   1-2.5   2.5-5   5-10   10-20   +20   TOTAL

           QUARTZ...      2      50      15      5      15     13     6.7

           KAOLINITE      0       9      14     39      27     11    13.3

           ILLITE...      0      14      16     63       7      0     4.3

           PYRITE...      0       8       2     17      19     54     8.2

           SIDERITE.      0       0       2     11      24     62    21.1

           CALCITE..      0       0       3     39      23     36     2.0

           FE-SUL...      0       0       0      0      41     59     1.8

           QUARORG..      8      59      26      0       7      0     1.7

           MIXSIL...      1      25       9     27      12     26    13.8

           NOT-INT..      1      17      15     12      22     33    21.2

           UNKNOWN..      3      21      18     40       8      9     4.0

           MISC.....     20       7      28     16      13     15     2.0

           TOTAL....      1      15      10     21      20     33   100.0



                              AVERAGE COMPOSITION
          TYPE          AVE    NA    MG    AL    SI     S    CL     P     K    CA    TI    FE    WT%
          QUARTZ...    1.64           0          93     1     1           1     1     2     1    6.7
          KAOLINITE    4.12     1          42    48     2     1           2     2     3     3   13.3
          ILLITE...    3.68     1          33    46     2     1          10     2     1     3    4.3
          CHAMOSITE    3.45     1          20    28     5     1           0     1     3    41    0.3
          ORGSULF..    5.84     1                 4    86                       4           4    0.2
          PYJAR....    4.86     2           4     4    54                 3     1          33    0.4
          PYRITE...    2.90           1     2     2    62                 1     0     1    33    8.2
          SIDERITE.   10.13           1     3     2     2     1     0     1    11     2    77   21.1
          CALCITE..    6.48     0     0     3     2     1     0     1     2    89     1     2    2.0
          MONTMORIL   18.45     2          21    74           1                             3    0.3
          FE-SUL...   19.03     1     0     1     2    53                 0     1     1    42    1.8
          QUARORG..    1.01                58    18    12     5     2     1     2     2     1    1.7
          QUARPYR..    0.28                10    58    12     4           1     5           7    0.9
          MIXSIL...    2.52     1          34    52     2     1           3     2     2     5   13.8
          NOT-INT..    1.97     1     1    32    25    10     5     2     8     8     8    15   21.2
          UNKNOWN..    1.42     0          81     2     2     4     2     2     2     2     4    4.0
```

SAMPLE: 88-268-01J   1.35 - 1.50 m

```
NUMBER     1  DISK   160     FILE 339 - 342  PARTICLES                                   RUN/T  342.99

RUN        1  DATE  4/26/88  SUMMARY   341   TOTAL    467     MASS 4.5E-01  UG/CM2  ANAL./T285.99

BLOCKS    24  TIME 10:25     OFF-PT.        ) 50U      5    ) 50U 9.6E-02  UG/CM2  DEAD/T  57.00

TABLE USED TO SCALE DATA

                        RUN PARAMETER TABLE
  MAG    BIN     XL      XU     PARTS  FIELDS  SCALE    MASS

  500     0     0.2     1.0        9   20.00    101  5.39E-03

  500     1     1.0     2.5       63   20.00    101  6.52E-02

  150     2     2.5     5.0      126   19.56      9  4.49E-02

  150     3     5.0    10.0       73   19.56      9  9.22E-02

   50     4    10.0    20.0      135   20.34      1  8.79E-02

   50     5    20.0    50.0       61   20.34      1  1.45E-01



                                        SIZE DISTRIBUTION

  TYPE            0.2-1   1-2.5   2.5-5   5-10    10-20    +20      PART/CM2   %TOTAL
   QUARTZ...        32      61       6      0        0      0      3.4E+03    10.2
   KAOLINITE         0      46      27     22        4      0      1.3E+03     3.9
   ILLITE...         0      55      24     20        1      0      5.6E+02     1.7
   CHAMOSITE         0       0     100      0        0      0      4.6E+01     0.1
   ORGSULF..         0       0       0    100        0      0      1.4E+01     0.0
   PYJAR....         0       0      90      0        0     10      1.6E+01     0.0
   PYRITE...         0      83       4      8        4      2      3.7E+02     1.1
   SIDERITE.         0       0      26     43       17     15      2.3E+02     0.7
   CALCITE..         0       0      29     62        7      2      6.8E+01     0.2
   MONTMORIL         0       0       0      0      100      0      2.0E+00     0.0
   FE-SUL...         0       0       0      0       67     33      9.6E+00     0.0
   QUARORG..        61      35       4      0        0      0      2.1E+03     6.4
   QUARPYR..        99       1       0      0        0      0      1.5E+04    44.4
   MIXSIL...        12      73       7      7        1      0      2.7E+03     8.2
   NOT-INT..        17      69      10      2        1      0      5.6E+03    16.8
   UNKNOWN..        53      37       6      4        0      0      2.1E+03     6.2

   TOTAL....        58      32       6      3        1      0      3.3E+04   100.0
```

```
SAMPLE: 88-268-01K       1.50 - 1.65 m

NUMBER     1  DISK   160     FILE 343 - 347  PARTICLES                         RUN/T  !18.00

RUN        1  DATE  4/27/88  SUMMARY   346   TOTAL   596     MASS 2.4E+00  UG/CM2   ANAL./T!87.99

BLOCKS    30  TIME  8:48     OFF-PT.       ) 50U      4    ) 50U 2.4E-01  UG/CM2   DEAD/T  30.00

                                        WEIGHT DISTRIBUTION

              TYPE           0.2-1   1-2.5   2.5-5   5-10   10-20    +20   TOTAL

               QUARTZ...         1      37      16     13      33      0     4.4

               KAOLINITE         0       5      26     40      14     16    13.4

               ILLITE...         8      40      25     14      13      0     1.8

               PYJAR....         7      70       7      0      16      0     1.5

               PYRITE...         1      12       5      8      32     42    57.9

               FE-SUL...         0       1       0      8      32     59     4.5

               MIXSIL...         2      22      20     31      11     14     8.2

               NOT-INT..         2      25       7      7      21     39     4.7

               MISC.....        12      27      31      0      16     15     3.6

               TOTAL....         1      15      11     14      26     33   100.0


                                              AVERAGE COMPOSITION
                TYPE         AVE     NA   MG   AL   SI    S   CL    P    K   CA   TI   FE   WT%
               QUARTZ...     2.27          1         92    2    1         1    1    1    2   4.4
               KAOLINITE     4.24     1         44   48    2    0         1    1    1    2  13.4
               ILLITE...     1.04     0         26   46    6    2        10    3    3    4   1.8
               CHAMOSITE     3.65     2         17   28    4    5              2        41   0.1
               ORGSULF..     1.14          2    5    4   57              8    5    1   17   0.0
               PYJAR....     1.43     0    1    2    3   61              4    1    2   26   1.5
               PYRITE...     2.50          0    2    2   63              0    1    1   32  57.9
               SIDERITE.    21.52     1         2    3   12              2    2        78   0.3
               CALCITE..     7.82     0         8    1    3    1    1        84    0    2   0.6
               MONTMORIL     0.68              18   71    1    1         0    3    6    0   0.4
               FE-SUL...     7.99     0    0    1    2   48              0    0    1   48   4.5
               QUARORG..     0.35     1        33   38   15    2         5    3    1    2   1.0
               QUARPYR..     0.65     1        18   44   16    2         5    2    3    9   0.8
               MIXSIL...     2.30     1        26   58    3    2    0    4    2    2    4   8.2
               NOT-INT..     1.63     2    1   30   34    9    4    1    6    3    4    8   4.7
               UNKNOWN..     0.29     3        62    2    8              6         9   10   0.4
```

```
SAMPLE: 88-268-01K    1.50 - 1.65 m

NUMBER      1  DISK   160     FILE 343 - 347  PARTICLES                           RUN/T  !18.00

RUN         1  DATE  4/27/88  SUMMARY   346   TOTAL   596     MASS 2.4E+00  UG/CM2  ANAL./T!87.99

BLOCKS     30  TIME  8:48     OFF-PT.         > 50U      4    > 50U 2.4E-01  UG/CM2  DEAD/T  30.00

TABLE USED TO SCALE DATA

                         RUN PARAMETER TABLE
  MAG    BIN     XL      XU      PARTS  FIELDS  SCALE    MASS

  500     0      0.2     1.0       31   13.40      30  3.39E-02

  500     1      1.0     2.5      169   13.40      30  3.51E-01

  150     2      2.5     5.0      142    4.28       8  2.48E-01

  150     3      5.0    10.0       58    4.28       8  3.35E-01

   50     4     10.0    20.0      147    4.14       1  6.18E-01

   50     5     20.0    50.0       49    4.14       1  7.75E-01



                                   SIZE DISTRIBUTION

 TYPE             0.2-1   1-2.5   2.5-5   5-10    10-20    +20       PART/CM2   %TOTAL
  QUARTZ...        12      71      12      4        2       0         7.1E+03     4.8
  KAOLINITE         0      28      45     25        2       1         7.3E+03     4.9
  ILLITE...        71      22       5      1        0       0         1.0E+04     7.1
  CHAMOSITE         0       0     100      0        0       0         6.5E+01     0.0
  ORGSULF..         0     100       0      0        0       0         3.0E+02     0.2
  PYJAR....        23      75       1      0        0       0         4.4E+03     3.0
  PYRITE...        23      62       7      3        3       1         1.9E+04    13.1
  SIDERITE.         0       0       0      0        0     100         7.9E+00     0.0
  CALCITE..         0       0      74      0       17       9         8.7E+01     0.1
  MONTMORIL        87      11       2      0        0       0         4.2E+03     2.8
  FE-SUL...         0      57       0     16       15      13         4.0E+02     0.3
  QUARORG..        95       5       0      0        0       0         4.3E+04    28.7
  QUARPYR..        80      16       4      0        0       0         1.0E+04     7.1
  MIXSIL...        26      50      17      6        0       0         1.1E+04     7.9
  NOT-INT..        21      72       5      1        1       0         9.4E+03     6.3
  UNKNOWN..        98       0       2      0        0       0         2.0E+04    13.9

  TOTAL....        62      28       7      3        1       0         1.4E+05   100.0
```

```
SAMPLE: 88-268-01L    1.65 - 1.80 m

NUMBER      1  DISK   160     FILE 348 - 352  PARTICLES                           RUN/T  199.00

RUN         1  DATE  4/27/88  SUMMARY   351   TOTAL   533    MASS 4.6E+00  UG/CM2  ANAL./T 92.99

BLOCKS     27  TIME 10:53     OFF-PT.       > 50U     0    > 50U 0.0E+00  UG/CM2  DEAD/T 106.00

                                 WEIGHT DISTRIBUTION

          TYPE          0.2-1   1-2.5   2.5-5   5-10   10-20   +20   TOTAL

           QUARTZ...      0       8      42      37     12      0     3.3

           KAOLINITE      0       2       6      55      7     29     7.7

           ILLITE...      0       2      18      70      5      5    13.0

           PYJAR....      2       5      44      42      7      0     2.2

           PYRITE...      0       2      17      51     23      7    43.5

           QUARORG..      0       5      27      66      2      0     3.7

           QUARPYR..      1       4      29      64      3      0     2.6

           MIXSIL...      0       3      22      52      8     15    11.0

           NOT-INT..      0       5      27      54      6      8    10.8

           MISC.....      1       3       0       0     54     43     2.3

           TOTAL....      0       3      20      53     15      9   100.0


                                    AVERAGE COMPOSITION
  TYPE           AVE    NA    MG    AL    SI     S    CL     P     K    CA    TI    FE    WT%
QUARTZ...       2.96     0                92     2     1           1     0     2     1    3.3
KAOLINITE       4.46     1          41    47     4     1           2     2     2     4    7.7
ILLITE...       4.67     1          26    46     6     2          14     1     2     4   13.0
PYJAR....       2.73     1     1     5     6    56     1           4     1     1    25    2.2
PYRITE...       5.01     0     0     2     3    62                 1     0     1    32   43.5
CALCITE..      15.55           1     2     1     2     1     1     0    92     1     1    0.8
FE-SUL...      17.51     0           2     2    50                 0     1     1    45    1.3
QUARORG..       3.81     1     1    21    45    16     1     0     8     2     2     3    3.7
QUARPYR..       1.02                25    28    23     0           7     0     5    13    2.6
MIXSIL...       4.55     0     0    26    49     3     2           9     2     2     6   11.0
MIXSUL...       1.03           1     2     6    47     2           4     6          31    0.0
NOT-INT..       2.81     1     2    19    42    10     3     4     7     8     4     9   10.8
UNKNOWN..       2.50     1     0    26    30    16     0           1     1     2    22    0.1
```

```
SAMPLE: 88-268-01L        1.65 - 1.80 m

NUMBER     1  DISK   160     FILE 348 - 352  PARTICLES                                        RUN/T  199.00

RUN        1  DATE  4/27/88  SUMMARY   351   TOTAL   533     MASS 4.6E+00  UG/CM2   ANAL./T 92.99

BLOCKS    27  TIME 10:53     OFF-PT.        ) 50U      0    ) 50U 0.0E+00  UG/CM2   DEAD/T 106.00

TABLE USED TO SCALE DATA

                      RUN PARAMETER TABLE
  MAG     BIN      XL       XU      PARTS  FIELDS  SCALE     MASS

  500      0      0.2      1.0        17   20.00      20  1.07E-02

  500      1      1.0      2.5       116   20.00      20  1.27E-01

  150      2      2.5      5.0       113    1.16      32  8.89E-01

  150      3      5.0     10.0        87    1.16      32  2.41E+00

   50      4     10.0     20.0       164    4.19       1  6.67E-01

   50      5     20.0     50.0        36    4.19       1  4.28E-01



                                    SIZE DISTRIBUTION

 TYPE               0.2-1    1-2.5    2.5-5    5-10     10-20     +20        PART/CM2   %TOTAL
  QUARTZ...          16       30       44        8        1        0         5.6E+03      5.9
  KAOLINITE          14       24       24       34        1        1         5.5E+03      5.9
  ILLITE...           8       19       36       35        1        0         1.1E+04     12.1
  PYJAR....          21       29       41        8        0        0         2.9E+03      3.1
  PYRITE...           0       21       41       33        5        0         1.5E+04     15.8
  CALCITE..           0        0        0        0       75       25         6.0E+01      0.1
  FE-SUL...           0        0        0        0       85       15         9.9E+01      0.1
  QUARORG..           8       34       34       24        0        0         4.9E+03      5.2
  QUARPYR..          78        6       10        7        0        0         1.7E+04     18.6
  MIXSIL...          13       20       35       30        1        0         1.0E+04     10.8
  MIXSUL...          76       24        0        0        0        0         6.4E+02      0.7
  NOT-INT..          21       31       30       18        1        0         2.0E+04     21.4
  UNKNOWN..           0       95        0        0        5        0         3.2E+02      0.3

  TOTAL....          25       22       30       22        1        0         9.5E+04    100.0
```

4. Harbour Seam - Lingan Mine

Sandstone Roof

```
SAMPLE: 88-268-04A       0.00 - 0.15 m

NUMBER     1  DISK   164     FILE 455 - 458  PARTICLES                         RUN/T  231.00

RUN        1  DATE  6/ 1/88  SUMMARY   457   TOTAL   381     MASS 9.2E-01  UG/CM2   ANAL./T136.00

BLOCKS    21  TIME 10:57     OFF-PT.         ) 50U     29    ) 50U 4.0E+00  UG/CM2   DEAD/T  95.00

                                   WEIGHT DISTRIBUTION

          TYPE             0.2-1   1-2.5   2.5-5   5-10    10-20    +20   TOTAL

           QUARTZ...          0       8      18       7      23      44     3.6

           KAOLINITE          0       0      12      19      41      28     7.3

           ILLITE...          0       0      17      23      33      27     1.9

           PYRITE...          0       0       8      12      15      65    68.4

           FE-SUL...          0       0       1       2       5      92     7.5

           MIXSIL...          0       7      13       5      21      54     5.2

           APATITE..          0       0       0       0       0     100     1.5

           MISC.....          1       5      53      20      15       6     4.5

           TOTAL....          0       1      10      12      17      60   100.0


                                   AVERAGE COMPOSITION
           TYPE          AVE    NA    MG    AL    SI     S    CL     P     K    CA    TI    FE   WT%
          QUARTZ...     3.54     0     1     1    93     2     0           2     1     1     2   3.6
          KAOLINITE     6.11     1           43    49     1     1           1     1     3     2   7.3
          ILLITE...     5.23     1           32    47     3     1          10     1     1     3   1.9
          CHAMOSITE     3.51     1           31    33                             2          32   0.0
          PYJAR....     3.34     1     1     3     4    60                 3     1     2    25   0.5
          PYRITE...     6.49           0     0     2    62                 0     0     1    33  68.4
          HALITE...     6.26    14           1     2          82     1                           0.2
          SIDERITE.     4.53     0     2     7     6    14     1           2     2          66   0.3
          CALCITE..     6.36           2     4     2     3     0     1     2    83     2     2   0.5
          MONTMORIL     3.95     1           11    78     4                 3           2     1   0.1
          FE-SUL...    16.36     1     0     1     2    50                 1     1     2    44   7.5
          QUARORG..     1.99     0           68    12    11     1     2     2     2     2     2   0.6
          QUARPYR..     4.35                 52     8    21     1           3     2     3    11   0.3
          MIXSIL...     3.51     1     1    35    50     3     1           4     2     2     6   5.2
          APATITE..    22.51     0                             0    24     1    72     2     2   1.5
          NOT-INT..     1.00     1     1    22    18    31     5     2     3     2     9     9   1.0
          UNKNOWN..     3.27     2          78     5     1     4     2     2     2     3     3   1.0
```

```
SAMPLE: 88-268-04A        0.00 - 0.15 m

NUMBER     1  DISK   164     FILE 455 - 458  PARTICLES                         RUN/T  231.00

RUN        1  DATE  6/ 1/88  SUMMARY   457   TOTAL   381     MASS 9.2E-01  UG/CM2  ANAL./T136.00

BLOCKS    21  TIME 10:57     OFF-PT.        > 50U     29    > 50U 4.0E+00  UG/CM2  DEAD/T  95.00

TABLE USED TO SCALE DATA

                          RUN PARAMETER TABLE
    MAG     BIN     XL      XU      PARTS  FIELDS   SCALE     MASS

    500      0     0.2     1.0        1    20.00      56   6.00E-04

    500      1     1.0     2.5        9    20.00      56   9.60E-03

    150      2     2.5     5.0      151    15.40       6   9.20E-02

    150      3     5.0    10.0       49    15.40       6   1.05E-01

     50      4    10.0    20.0      104    11.26       1   1.49E-01

     50      5    20.0    50.0       67    11.26       1   5.44E-01



                                        SIZE DISTRIBUTION

              TYPE            0.2-1   1-2.5   2.5-5   5-10   10-20    +20     PART/CM2   %TOTAL
               QUARTZ...        0       56      33      7      4       1      5.4E+02     7.2
               KAOLINITE        0        0      56     27     14       3      6.6E+02     8.8
               ILLITE...        0        0      67     22     10       1      2.4E+02     3.2
               CHAMOSITE        0        0     100      0      0       0      1.8E+01     0.2
               PYJAR....        0        0     100      0      0       0      1.4E+02     2.0
               PYRITE...        0        9      53     26      7       6      1.7E+03    23.0
               HALITE...        0        0      87      0     13       0      2.1E+01     0.3
               SIDERITE.        0        0      50     50      0       0      3.6E+01     0.5
               CALCITE..        0        0      32     63      5       0      5.7E+01     0.8
               MONTMORIL        0        0     100      0      0       0      1.8E+01     0.2
               FE-SUL...        0        0      28     28      9      35      6.3E+01     0.8
               QUARORG..        0       69      28      3      0       0      5.9E+02     7.9
               QUARPYR..        0        0      76     24      0       0      7.6E+01     1.0
               MIXSIL...        0       56      33      4      4       2      8.3E+02    10.9
               APATITE..        0        0       0      0      0     100      1.1E+01     0.1
               NOT-INT..       87        0      12      1      0       0      2.1E+03    28.3
               UNKNOWN..        0       43      55      0      2       1      3.6E+02     4.8

               TOTAL....       25       20      38     12      4       2      7.5E+03   100.0
```

```
SAMPLE: 88-268-04B        0.15 - 0.30 m

NUMBER     1  DISK   164    FILE 459 - 462  PARTICLES                         RUN/T  129.00

RUN        1  DATE  6/ 1/88  SUMMARY   461   TOTAL   404    MASS 2.0E+00  UG/CM2  ANAL./T100.99

BLOCKS    21  TIME 14:14     OFF-PT.       > 50U     8   > 50U 1.0E+00  UG/CM2  DEAD/T  28.00

                              WEIGHT DISTRIBUTION

             TYPE         .2-1.  1.-2.5  2.5-5.   5.-10   10-20     +20   TOTAL

             KAOLINITE        0       0      31      50      19       0     1.8

             PYRITE...        0       0       1       4      16      78    92.0

             FE-SUL...        0       0       0       2      10      87     3.3

             MISC.....        1      12      34      24      20       9     2.9

             TOTAL....        0       1       3       6      16      75   100.0



                                      AVERAGE COMPOSITION
TYPE             AVE    NA    MG    AL    SI     S    CL     P     K    CA    TI    FE      WT%
QUARTZ...       3.59     0     1          94     0     1           1     1     1     1      0.1
KAOLINITE       5.04     0          41    49     2     1           0     2     2     2      1.8
ILLITE...       3.60     1          34    48     3     1     1     8     1     2     1      0.1
PYJAR....       3.03     1     0     2     2    62                 4     2     0    27      0.1
PYRITE...      11.21     1     0     1     2    62                 1     0     1    34     92.0
CALCITE..       2.78     1           3     3     3           1          81     6     2      0.0
FE-SUL...      22.21     0     1     0     1    54                 1           2    42      3.3
QUARORG..       4.14                87           7     1     1     1     0     2     2      0.1
QUARPYR..       2.64     2           5     8    47     1                 2     2    32      0.0
MIXSIL...       5.53     0     0    40    50     3     0           3     1     2     2      1.5
MIXSUL...       3.06     1           1     1    47                      24          26      0.0
NOT-INT..       1.75     1     3    43    31     6     3     2     5     2     4     6      0.9
UNKNOWN..       4.67                92     2     1                 3                 1      0.0
```

```
SAMPLE: 88-268-04B          0.15 - 0.30 m

NUMBER     1  DISK   164    FILE 459 - 462  PARTICLES                                       RUN/T  129.00

RUN        1  DATE  6/ 1/88 SUMMARY   461   TOTAL   404    MASS 2.0E+00  UG/CM2  ANAL./T100.99

BLOCKS    21  TIME 14:14    OFF-PT.        > 50U      8   > 50U 1.0E+00  UG/CM2  DEAD/T  28.00

TABLE USED TO SCALE DATA

                   RUN PARAMETER TABLE
  MAG    BIN     XL      XU     PARTS  FIELDS  SCALE    MASS

  500     0     0.2     1.0        1   20.00      35  6.00E-04

  500     1     1.0     2.5       11   20.00      35  1.12E-02

  150     2     2.5     5.0      133   20.83       3  6.00E-02

  150     3     5.0    10.0       67   20.83       3  1.18E-01

   50     4    10.0    20.0       94    7.03       1  3.21E-01

   50     5    20.0    50.0       98    7.03       1  1.53E+00



                                     SIZE DISTRIBUTION

  TYPE            .2-1.  1.-2.5   2.5-5.   5.-10  10-20     +20     PART/CM2   %TOTAL
  QUARTZ...          0       0      87      13      0       0      1.0E+02     1.6
  KAOLINITE          0       0      61      36      3       0      7.1E+02    11.6
  ILLITE...          0       0     100       0      0       0      8.0E+01     1.3
  PYJAR....          0       0     100       0      0       0      7.0E+01     1.1
  PYRITE...          0      16      26      21     18      20      1.9E+03    32.5
  CALCITE..          0       0     100       0      0       0      1.6E+01     0.3
  FE-SUL...          0       0       0      25     25      50      5.3E+01     0.9
  QUARORG..          0       0     100       0      0       0      4.0E+01     0.7
  QUARPYR..          0       0     100       0      0       0      1.8E+01     0.3
  MIXSIL...          0       0      67      24      8       1      3.8E+02     6.3
  MIXSUL...          0       0     100       0      0       0      1.3E+01     0.2
  NOT-INT..         13      72      12       4      0       0      2.6E+03    43.0
  UNKNOWN..          0       0     100       0      0       0      1.3E+01     0.2

  TOTAL....          5      36      30      15      7       7      6.1E+03   100.0
```

```
SAMPLE: 88-268-04C        0.30 - 0.45 m

NUMBER    1  DISK   164    FILE 465 - 468  PARTICLES                                RUN/T  142.00

RUN       1  DATE  6/ 7/88  SUMMARY   467   TOTAL   398    MASS 1.8E+00  UG/CM2   ANAL./T128.99

BLOCKS   21  TIME  9:23    OFF-PT.        > 50U     11   > 50U 1.4E+00  UG/CM2   DEAD/T  13.00

                                      WEIGHT DISTRIBUTION

            TYPE         .2-1.  1.-2.5  2.5-5.  5.-10  10-20    +20    TOTAL

            KAOLINITE      0      1       6      16     19      57      5.3

            PYRITE...      0      0       4       9     43      44     82.8

            FE-SUL...      0      0       0       0     16      84      4.0

            MIXSIL...      0      1       3       7     18      72      3.5

            MISC.....      0      3      35      23     38       0      4.4

            TOTAL....      0      0       5       9     39      46    100.0




                                        AVERAGE COMPOSITION
         TYPE          AVE      NA    MG    AL    SI     S    CL     P     K    CA    TI    FE     WT%
        QUARTZ...     5.43            1          94     2                 0     1     1     1     0.8
        KAOLINITE     6.99       0          42    48     3     1           2     2     2     2     5.3
        ILLITE...     4.93       1          36    48     3     1          10     1           1     0.2
        PYJAR....     4.15       1           1     1    67     1           3     0     1    28     0.3
        PYRITE...     6.96       0    1      1     2    63                 1     0     1    32    82.8
        CALCITE..    10.94       0    2      1     2     2     1     1          88     2     3     0.6
        DOLOMITE.     7.61           14                        1    25     4    55                 0.1
        FE-SUL...    23.48       0    0      2     2    51                 1     0     2    43     4.0
        QUARORG..     3.64       1          87     1     6     1     0     2     2     2     1     0.3
        QUARPYR..     2.00       1          71     6     8     2     1     4     2     2     4     0.3
        MIXSIL...     6.04       1    0     42    44     3     2           3     2     2     4     3.5
        NOT-INT..     3.19       2    2     41    17     8     5     4     6     8     5     6     1.4
        UNKNOWN..     3.66       1          80     2     2     1           2     3     2     6     0.5
```

```
SAMPLE: 88-268-04C    0.30 - 0.45 m

RUN        1  DATE  6/ 7/88  SUMMARY   467   TOTAL   398     MASS 1.8E+00  UG/CM2   ANAL./T128.99

BLOCKS    21  TIME  9:23     OFF-PT.        > 50U     11    > 50U 1.4E+00  UG/CM2   DEAD/T  13.00

TABLE USED TO SCALE DATA

                        RUN PARAMETER TABLE
   MAG     BIN     XL      XU      PARTS  FIELDS   SCALE     MASS

   500      0      0.2     1.0        2   24.00       20   1.85E-03

   500      1      1.0     2.5        7   24.00       20   5.60E-03

   150      2      2.5     5.0      135   16.18        2   8.77E-02

   150      3      5.0    10.0       65   16.18        2   1.66E-01

    50      4     10.0    20.0      138    4.95        1   6.93E-01

    50      5     20.0    50.0       51    4.95        1   8.00E-01


                                   SIZE DISTRIBUTION

         TYPE          .2-1.  1.-2.5   2.5-5.   5.-10   10-20    +20      PART/CM2   %TOTAL
         QUARTZ...        0       0       61      28      10       0      1.8E+02     2.7
         KAOLINITE        0      22       35      29       6       8      5.9E+02     8.8
         ILLITE...        0       0       50      50       0       0      6.9E+01     1.0
         PYJAR....        0       0       92       0       8       0      7.8E+01     1.1
         PYRITE...       27       4       26      18      20       6      3.5E+03    52.9
         CALCITE..        0       0       41       0      59       0      4.2E+01     0.6
         DOLOMITE.        0       0        0     100       0       0      1.7E+01     0.3
         FE-SUL...        0       0        0       0      44      56      5.6E+01     0.8
         QUARORG..        0       0       85      15       0       0      2.2E+02     3.4
         QUARPYR..        0      68       29       3       0       0      4.9E+02     7.2
         MIXSIL...        0      38       28      20       6       7      3.3E+02     5.0
         NOT-INT..        0      39       54       4       3       0      7.9E+02    11.7
         UNKNOWN..        0       0       86      11       2       0      2.9E+02     4.4

         TOTAL....       14      15       37      16      13       5      6.7E+03   100.0
```

```
SAMPLE: ACI-88-268-04COMP     0.45 - 1.20 m

NUMBER    1 DISK  166    FILE 490 - 494 PARTICLES                          RUN/T  174.00

RUN       1 DATE 6/15/88 SUMMARY   493  TOTAL   550   MASS 2.7E+00 UG/CM2  ANAL./T158.00

BLOCKS   29 TIME 9: 4    OFF-PT.      > 50U    11   > 50U 1.8E+00 UG/CM2  DEAD/T  16.00

                              WEIGHT DISTRIBUTION

          TYPE        .2-1.  1.-2.5  2.5-5.  5.-10  10-20   +20   TOTAL

          QUARTZ...     0      9      29      8      42     13      3.0

          KAOLINITE     0      8      15     48      29      0     11.6

          PYJAR....     0     20       9     24       6     41      1.6

          PYRITE...     0      5       8     12       9     66     67.0

          FE-SUL...     0      1       0      0      10     89      4.9

          MIXSIL...     1      8      12     21      43     15      6.7

          NOT-INT..     1     43       2     13      41      0      1.6

          MISC.....     4     22      10     10      24     30      3.6

          TOTAL....     0      7       9     16      16     51    100.0



                               AVERAGE COMPOSITION
          TYPE        AVE     NA   MG   AL   SI    S   CL    P    K   CA   TI   FE    WT%
          QUARTZ...   3.07     0    0    1   93    1    0         0         1    1    3.0
          KAOLINITE   3.65     1        42   49    3    1         2    2    2    3   11.6
          ILLITE...   2.10              32   48    4    2         9    2    2    2    1.4
          PYJAR....   2.09     1    1    4    3   59    0         3    1    2   26    1.6
          PYRITE...   3.69     0    0    1    2   63              0    0    1   33   67.0
          CALCITE..   6.79     1    1    1    1    0    1    1    0   93    1    1    0.5
          MONTMORIL   2.72     1        20   67    2    1         2    2    3    3    0.3
          FE-SUL...   7.13     0    0    1    2   49    1         2    2    2   45    4.9
          QUARORG..   0.29     1        82    2    6    5                        2    0.2
          QUARPYR..   0.47              30   37   17                   4    3   10    0.4
          MIXSIL...   0.80     1        30   55    4    2         2    1    2    4    6.7
          MIXSUL...   1.31          5             70                        3   21    0.0
          UNKCHLOR.  36.02     3         2    1        63        16    9         5    0.6
          NOT-INT..   0.98     2    1   26   46    9    6    1    4    2    2    5    1.6
          UNKNOWN..   2.48     2        22   28    0   16    8    0   20    2    0    0.2
```

```
SAMPLE: ACI-88-268-04COMP      0.45 - 1.20 m

NUMBER      1  DISK   166    FILE 490 - 494  PARTICLES                          RUN/T  174.00

RUN         1  DATE  6/15/88  SUMMARY   493   TOTAL   550    MASS 2.7E+00  UG/CM2   ANAL./T158.00

BLOCKS     29  TIME  9: 4    OFF-PT.        ) 50U     11    ) 50U 1.8E+00  UG/CM2   DEAD/T  16.00

TABLE USED TO SCALE DATA

                       RUN PARAMETER TABLE
   MAG     BIN     XL      XU     PARTS  FIELDS  SCALE     MASS

   500      0      0.2     1.0      14   21.00      21  8.95E-03

   500      1      1.0     2.5     147   21.00      21  1.79E-01

   150      2      2.5     5.0     125    5.28       7  2.45E-01

   150      3      5.0    10.0      75    5.28       7  4.31E-01

    50      4     10.0    20.0     131    4.46       1  4.14E-01

    50      5     20.0    50.0      58    4.46       1  1.35E+00



                               SIZE DISTRIBUTION

  TYPE           .2-1.  1.-2.5   2.5-5.   5.-10   10-20    +20      PART/CM2   %TOTAL
 QUARTZ...         0      55      36        4       4       0       2.3E+03     2.8
 KAOLINITE         5      46      24       22       4       0       8.5E+03    10.2
 ILLITE...        34      52      10        2       1       0       2.3E+03     2.8
 PYJAR....         0      87       8        4       1       1       1.3E+03     1.7
 PYRITE...         5      56      23       12       2       2       1.1E+04    14.2
 CALCITE..         0       0      67        0      25       8       8.7E+01     0.1
 MONTMORIL         0      76      20        0       4       0       3.8E+02     0.5
 FE-SUL...         0      77       0        0       7      16       3.9E+02     0.5
 QUARORG..        94       5       0        0       0       0       1.3E+04    16.1
 QUARPYR..        90      10       0        0       0       0       9.7E+03    11.7
 MIXSIL...        84      11       3        2       1       0       2.2E+04    27.3
 MIXSUL...         0     100       0        0       0       0       1.6E+02     0.2
 UNKCHLOR.         0       0       0        0       0     100       7.4E+00     0.0
 NOT-INT..        51      47       1        1       0       0       9.4E+03    11.4
 UNKNOWN..         0      74      13       13       0       0       4.1E+02     0.5

 TOTAL....        56      29       8        5       1       0       8.3E+04   100.0
```

```
SAMPLE: 88-268-041       1.20 - 1.35 m

NUMBER     1  DISK   164     FILE 469 - 472  PARTICLES                          RUN/T  182.00

RUN        1  DATE  6/ 7/88  SUMMARY   471   TOTAL   426     MASS 1.8E+00  UG/CM2  ANAL./T121.00

BLOCKS    22  TIME 14:17     OFF-PT.        > 50U      7    > 50U 3.5E-01  UG/CM2  DEAD/T  60.99

                                    WEIGHT DISTRIBUTION

            TYPE          .2-1.  1.-2.5   2.5-5.   5.-10  10-20    +20    TOTAL

            KAOLINITE       0       5       15      38     32      10       8.2

            PYRITE...       0       0        6      10     16      68      73.9

            FE-SUL...       0       1        1       1      9      88       8.5

            MIXSIL...       1       2       10       9     14      64       5.0

            MISC.....       2      18       28      26     19       8       4.3

            TOTAL....       0       1        7      12     17      62     100.0



                                    AVERAGE COMPOSITION
          TYPE          AVE      NA     MG     AL     SI      S     CL      P      K     CA     TI     FE      WT%
          KAOLINITE    4.76       1            42     49      2      1             2      2      2      2      8.2
          ILLITE...    3.29       1            37     46      4      1             7      1      1      2      0.9
          PYJAR....    2.35       0      1      2      2     64                    3      0      1     27      0.6
          PYRITE...    6.30       0      0      1      0     62                    1             1     34     73.9
          HALITE...    4.75      14            12      1            64      4      2      1      1             0.1
          CALCITE..    5.74              4      0      2             2      1      4     84      1      3      0.1
          FE-SUL...    4.00       0      1      2      2     51                    0      1      1     44      8.5
          QUARORG..    1.85       0            74      8      8      1      0             2      3      2      0.3
          QUARPYR..    1.67       0            81      0      9      1      0      1      2      1      5      0.3
          MIXSIL...    2.94       1      2     39     50      3      1             1      2      2      2      5.0
          UNKCHLOR.    3.50      20             9      1            67      0      0                    2      0.1
          NOT-INT..    1.27       2      1     42     18     17      3      2      2      2      2      8      1.1
          UNKNOWN..    3.96       1            76      5      2      2      5      2      6      2      2      0.8
```

```
SAMPLE: 88-268-04I     1.20 - 1.35 m

RUN        1  DATE  6/ 7/88  SUMMARY   471   TOTAL   426    MASS 1.8E+00  UG/CM2   ANAL./T121.00

BLOCKS    22  TIME 14:17    OFF-PT.        > 50U     7    > 50U 3.5E-01  UG/CM2   DEAD/T  60.99

TABLE USED TO SCALE DATA

                         RUN PARAMETER TABLE
  MAG     BIN      XL      XU      PARTS  FIELDS   SCALE     MASS

  500      0      0.2     1.0        5    20.00      34   3.51E-03

  500      1      1.0     2.5       28    20.00      34   2.71E-02

  150      2      2.5     5.0      132    11.24       5   1.33E-01

  150      3      5.0    10.0       68    11.24       5   2.15E-01

   50      4     10.0    20.0      106     6.88       1   3.10E-01

   50      5     20.0    50.0       87     6.88       1   1.12E+00




                                   SIZE DISTRIBUTION

         TYPE          .2-1.  1.-2.5   2.5-5.   5.-10   10-20    +20      PART/CM2   %TOTAL
        KAOLINITE        0      38       33       23       6      1        2.4E+03    17.3
        ILLITE...        0      71       17        6       7      0        4.3E+02     3.1
        PYJAR....        0      63       32        5       0      0        4.9E+02     3.4
        PYRITE...       12      15       38       21       7      7        3.4E+03    24.4
        HALITE...        0       0       50       50       0      0        4.9E+01     0.3
        CALCITE..        0       0       85        0      15      0        2.9E+01     0.2
        FE-SUL...       65      17        5        3       2      8        9.2E+02     6.5
        QUARORG..        0      77       14        8       0      0        5.8E+02     4.1
        QUARPYR..       47      38       12        3       0      0        8.1E+02     5.7
        MIXSIL...       42      25       24        5       2      2        1.4E+03    10.5
        UNKCHLOR.        0       0      100        0       0      0        4.9E+01     0.3
        NOT-INT..       44      47        8        0       0      0        3.0E+03    21.2
        UNKNOWN..        0      36       30       34       0      0        4.3E+02     3.0

        TOTAL....       23      35       24       12       3      3        1.4E+04   100.0
```

```
SAMPLE: ACI-88-268-04J    1.35 - 1.50 m

NUMBER     1  DISK   164     FILE 475 - 478  PARTICLES                            RUN/T  111.99

RUN        1  DATE  6/ 9/88  SUMMARY   477   TOTAL   397    MASS 1.2E+00  UG/CM2  ANAL./T103.00

BLOCKS    21  TIME 14:30     OFF-PT.        > 50U     15    > 50U 7.5E-01  UG/CM2  DEAD/T   8.99

                                 WEIGHT DISTRIBUTION

              TYPE        .2-1.  1.-2.5  2.5-5.  5.-10  10-20    +20    TOTAL

              KAOLINITE      0      0      18      38     38      6      5.1

              PYRITE...      0      0       4      12     26     58     71.8

              FE-SUL...      0      0       3       2     12     83      8.0

              MIXSIL...      0      0      18      25     46     11      3.2

              NOT-INT..      0      5      30      42     20      2      7.4

              MISC.....      2      8      30      26     16     18      4.5

              TOTAL....      0      1       8      16     25     50    100.0



                                 AVERAGE COMPOSITION
 TYPE          AVE    NA    MG    AL    SI     S    CL     P     K    CA    TI    FE     WT%
QUARTZ...     4.99           0          96     1                                   2     0.1
KAOLINITE     5.85     1          44    46     2     1           1     2     2     2     5.1
ILLITE...     2.52     0          35    47     6     1           7     1           3     0.6
PYJAR....     4.35     1     1     1     3    64                 2     1     1    28     0.4
PYRITE...     9.10           1     3     2    60                 0     1     1    34    71.8
HALITE...     3.65    18           2     1          69     1     3     1     1     3     0.1
SIDERITE.    10.42           0     1     4    19     0     0     0     1     0    74     1.3
CALCITE..     2.92                       2     2     2     2     1    91           1     0.0
FE-SUL...    11.34     0     0     2     3    51                 0     0     2    44     8.0
QUARORG..     1.12     1          74     8     6     1     3     3     2     1     1     0.6
QUARPYR..     0.88                70     2    17     2                 1     0     8     0.3
MIXSIL...     6.10     1          46    42     2     1           2     3     2     3     3.2
MIXSUL...     3.50     4           2     5    41     4           2    35     8           0.0
NOT-INT..     3.74     2     2    38    18     7     6     6     6    11     6    12     7.4
UNKNOWN..     2.58     1     1    65     5     3    10     1     6     3     2     3     1.0
```

```
SAMPLE: ACI-88-268-04J      1.35 - 1.50 m

NUMBER     1  DISK   164     FILE 475 - 478  PARTICLES                          RUN/T  111.99

RUN        1  DATE  6/ 9/88  SUMMARY   477   TOTAL   397    MASS 1.2E+00  UG/CM2  ANAL./T103.00

BLOCKS    21  TIME 14:30     OFF-PT.       > 50U     15    > 50U 7.5E-01  UG/CM2  DEAD/T   8.99

TABLE USED TO SCALE DATA

                             RUN PARAMETER TABLE
     MAG     BIN     XL      XU      PARTS  FIELDS  SCALE     MASS

     500      0      0.2     1.0         2   20.00     39  1.20E-03

     500      1      1.0     2.5        10   20.00     39  1.08E-02

     150      2      2.5     5.0       134   11.62      6  9.73E-02

     150      3      5.0    10.0        66   11.62      6  1.92E-01

      50      4     10.0    20.0       131    7.85      1  3.12E-01

      50      5     20.0    50.0        54    7.85      1  6.15E-01




                                   SIZE DISTRIBUTION

             TYPE         .2-1.  1.-2.5  2.5-5.  5.-10  10-20   +20     PART/CM2   %TOTAL
            QUARTZ...       0       0      86      0     14      0      2.8E+01     0.3
            KAOLINITE       0       0      56     33     11      0      8.6E+02     9.0
            ILLITE...       0      72       6     18      4      0      4.0E+02     4.1
            PYJAR....       0       0     100      0      0      0      9.6E+01     1.0
            PYRITE...       0      10      32     30     19     10      1.5E+03    16.4
            HALITE...       0       0     100      0      0      0      2.4E+01     0.2
            SIDERITE.       0       0       0     86      7      7      5.6E+01     0.6
            CALCITE..       0       0     100      0      0      0      2.4E+01     0.2
            FE-SUL...       0       0      55     13     11     21      1.8E+02     1.9
            QUARORG..      78      10       9      3      0      0      1.5E+03    16.2
            QUARPYR..      91       0       9      0      0      0      1.1E+03    11.7
            MIXSIL...       0       0      61     25     13      1      4.8E+02     4.9
            MIXSUL...       0       0     100      0      0      0      2.4E+01     0.2
            NOT-INT..       0      28      52     18      2      0      2.7E+03    28.3
            UNKNOWN..       0      65      32      0      2      1      4.7E+02     4.9

            TOTAL....      23      17      35     16      6      2      9.7E+03   100.0
```

```
SAMPLE: ACI-88-268-04K      1.50 - 1.65 m

NUMBER     1  DISK   166    FILE 480 - 484  PARTICLES                              RUN/T  454.00

RUN        1  DATE  6/13/88  SUMMARY   483   TOTAL   596    MASS 2.1E+00  UG/CM2   ANAL./T421.99

BLOCKS    30  TIME  8:17    OFF-PT.        > 50U      4   > 50U 3.3E-01  UG/CM2   DEAD/T  32.00

                                    WEIGHT DISTRIBUTION

            TYPE          0.2-1   1-2.5   2.5-5   5-10    10-20    +20    TOTAL

             QUARTZ...       0       7      31      35      13      14     11.8

             KAOLINITE       0       4      20      34      38       3      7.7

             ILLITE...       6      15      42      15      11      12      4.5

             PYRITE...       0       7      12      38      23      20     52.1

             FE-SUL...       0       3       0       0      21      76      5.1

             QUARORG..      19      53      19       9       0       0      1.9

             MIXSIL...       1      19      32      11      22      16      6.6

             NOT-INT..       1      35      10      21      10      23      6.0

             MISC.....       8      33       7       0      18      34      4.2

             TOTAL....       1      11      17      29      21      21    100.0



                                     AVERAGE COMPOSITION
            TYPE          AVE      NA    MG    AL    SI     S    CL     P     K    CA    TI    FE   WT%
           QUARTZ...     3.45       0     0     1    92     1     1           1     0     1     1  11.8
           KAOLINITE     3.72       0          44    47     2     1           2     2     2     3   7.7
           ILLITE...     1.50       1          28    47     6     0          12     2     2     3   4.5
           PYJAR....     0.95                   2     6    59                 4           3    26   0.3
           PYRITE...     3.30       1           1     2    64                 0     1     1    32  52.1
           CALCITE..    44.82             0           2     3           1     0    91     0     2   1.4
           RUTILE...     2.01                   3    12     8     1           3          70     3   0.1
           MONTMORIL     2.60       1          16    72     5                 3     2     1     2   0.4
           FE-SUL...     5.90       0     0     1     2    50                 1     0     2    45   5.1
           QUARORG..     0.55       0          29    47    14     0           6     1     2     1   1.9
           QUARPYR..     0.48       0     1    17    44    13     4           6     3     3     8   1.4
           MIXSIL...     2.54       0          22    62     3     1           5     2     4     4   6.6
           NOT-INT..     1.72       1     2    27    41     9     2     2     6     4     6     7   6.0
           UNKNOWN..     0.69       1          30    23    10     1     1     7    14     4     8   0.5
```

```
 SAMPLE: ACI-88-268-04K     1.50 - 1.65 m
RUN        1  DATE  6/13/88  SUMMARY   483   TOTAL   596    MASS 2.1E+00  UG/CM2   ANAL./T421.99

BLOCKS    30  TIME  8:17     OFF-PT.        ) 50U     4    ) 50U 3.3E-01  UG/CM2   DEAD/T  32.00

TABLE USED TO SCALE DATA

                         RUN PARAMETER TABLE
    MAG     BIN     XL      XU      PARTS  FIELDS  SCALE    MASS

    500      0      0.2     1.0       32   15.58      35  2.63E-02

    500      1      1.0     2.5      168   15.58      35  2.40E-01

    150      2      2.5     5.0      146    3.46      14  3.45E-01

    150      3      5.0    10.0       54    3.46      14  6.13E-01

     50      4     10.0    20.0      158    5.56       1  4.37E-01

     50      5     20.0    50.0       38    5.56       1  4.29E-01




                                SIZE DISTRIBUTION

    TYPE          0.2-1   1-2.5   2.5-5   5-10    10-20    +20      PART/CM2   %TOTAL
     QUARTZ...       0      40      45      13       1       0      7.2E+03     5.8
     KAOLINITE      16      29      33      16       6       0      4.0E+03     3.3
     ILLITE...      57      26      15       1       0       0      1.1E+04     9.1
     PYJAR....      46      54       0       0       0       0      1.9E+03     1.6
     PYRITE...       5      55      21      15       3       1      1.2E+04    10.4
     CALCITE..       0       0       0       0       0     100      1.1E+01     0.0
     RUTILE...       0     100       0       0       0       0      1.9E+02     0.2
     MONTMORIL       0      95       0       0       5       0      2.0E+02     0.2
     FE-SUL...       0      81       0       0       9       9      4.8E+02     0.4
     QUARORG..      88      11       1       0       0       0      3.3E+04    26.9
     QUARPYR..      89       9       1       0       0       0      2.5E+04    20.6
     MIXSIL...       6      61      28       3       1       0      7.2E+03     5.8
     NOT-INT..      10      81       6       2       0       0      1.2E+04    10.4
     UNKNOWN..      84      15       1       0       0       0      6.7E+03     5.4

     TOTAL....      55      31      10       3       1       0      1.2E+05   100.0
```

5. Phalen Seam - Phalen Colliery

Shale Roof

```
SAMPLE: PHALEN 268-05-B    0.00 - 0.15 m

NUMBER     1  DISK   179     FILE 108 - 111  PARTICLES                               RUN/T  219.00

RUN        1  DATE  8/18/88  SUMMARY   110   TOTAL   419     MASS 1.6E+00  UG/CM2   ANAL./T 90.00

BLOCKS    22  TIME 11:20     OFF-PT.        > 50U      9    > 50% 1.9E+00  UG/CM2   DEAD/T 129.00

                                      WEIGHT DISTRIBUTION

           TYPE          0.2-1   1-2.5   2.5-5   5-10    10-20    +20    TOTAL

            QUARTZ...      0       4      11      47      31       7      5.1

            KAOLINITE      0       0       4      78      18       0      1.7

            PYJAR....      0       0      24      41      14      21      5.6

            PYRITE...      0       0       4      17      40      38     68.3

            FE-SUL...      0       0       2      21      22      55      2.5

            NOT-INT..      0       2      12       8      33      45     10.3

            UNKNOWN..      9      48      13      13      17       0      1.6

            MISC.....      2       3      22      25      27      21      4.8

            TOTAL....      0       1       7      21      36      35    100.0


                                   AVERAGE COMPOSITION
           TYPE         AVE    NA    MG    AL    SI     S    CL     P     K    CA    TI    FE   WT%
          QUARTZ...     5.18          0          92     2     1           1     1     1     1   5.1
          KAOLINITE     7.36    0          42    48     2     1           2     2     2     2   1.7
          ILLITE...     4.49    1          31    46     1     2          14     1     2     1   0.4
          ORGSULF..     3.65    1     1    17          56                 6           2    16   0.0
          PYJAR....     5.67    2     1     4     2    60                 3     1     1    28   5.6
          PYRITE...     8.56    1           2     2    61                 0     1     2    33  68.3
          HALITE...    42.18   17           1     2          60           3    11     3     3   1.0
          CALCITE..    14.06          1     2           2           3          90     3         0.1
          FE-SUL...     9.67    0     0     2     2    48     1           1     1     2    43   2.5
          QUARORG..     1.90    1          57    11    16     4     0     3     4     2     4   1.1
          QUARPYR..     1.71    0          60    14    10     4     1     2     1     2     6   0.8
          MIXSIL...     4.76    1          25    58     4     2           4     2     1     4   1.2
          UNKCHLOR.    17.57    6           1                90                 3               0.2
          NOT-INT..     4.08    2     2    36    19    14     9     3     6     9     5     9  10.3
          UNKNOWN..     1.39    2          59     3     8    12     1     2     7     2     4   1.6
```

```
SAMPLE: PHALEN 268-05-B       0.00 - 0.15 m

NUMBER     1  DISK   179     FILE 108 - 111  PARTICLES                                RUN/T  219.00

RUN        1  DATE  8/18/88  SUMMARY   110   TOTAL   419     MASS 1.6E+00  UG/CM2   ANAL./T 90.00

BLOCKS    22  TIME 11:20     OFF-PT.         ) 50U      9    ) 50U 1.9E+00  UG/CM2   DEAD/T 129.00

TABLE USED TO SCALE DATA

                   RUN PARAMETER TABLE
   MAG     BIN      XL      XU     PARTS  FIELDS  SCALE    MASS

   500      0      0.2     1.0        7   20.00      26  4.20E-03

   500      1      1.0     2.5       22   20.00      26  2.23E-02

   150      2      2.5     5.0      115   11.00       4  1.16E-01

   150      3      5.0    10.0       84   11.00       4  3.28E-01

    50      4     10.0    20.0      145    5.20       1  5.65E-01

    50      5     20.0    50.0       46    5.20       1  5.47E-01




                              SIZE DISTRIBUTION

    TYPE             0.2-1   1-2.5   2.5-5   5-10   10-20    +20     PART/CM2   %TOTAL
     QUARTZ...          0      28      26     38       8      1      1.1E+03      8.2
     KAOLINITE          0       0      10     84       6      0      2.4E+02      1.8
     ILLITE...          0       0      87      0      13      0      1.2E+02      0.9
     ORGSULF..          0       0     100      0       0      0      2.5E+01      0.2
     PYJAR....          0       0      62     33       3      2      6.1E+02      4.5
     PYRITE...          0       6      30     36      21      7      2.4E+03     17.6
     HALITE...          0       0       0      0       0    100      6.4E+00      0.0
     CALCITE..          0       0       0      0     100      0      6.4E+00      0.0
     FE-SUL...          0       0      19     58      14      9      1.3E+02      1.0
     QUARORG..         48      29      17      5       1      0      1.0E+03      7.9
     QUARPYR..         65      18      10      6       2      0      8.5E+02      6.3
     MIXSIL...          0       0      66     32       2      0      3.1E+02      2.3
     UNKCHLOR.          0       0       0      0     100      0      6.4E+00      0.0
     NOT-INT..         19      27      38      4       9      3      2.4E+03     17.6
     UNKNOWN..         46      51       2      1       0      0      4.3E+03     31.6

     TOTAL....         26      28      22     16       7      2      1.3E+04    100.0
```

```
SAMPLE: PHALEN 268-05C          0.15 - 0.30 m

NUMBER     0  DISK   174     FILE 106 - 110  PARTICLES                          RUN/T  233.00

RUN        1  DATE  8/ 9/88  SUMMARY   109   TOTAL   598     MASS 1.4E+00  UG/CM2  ANAL./T 99.00

BLOCKS    30  TIME 11:24     OFF-PT.       > 50U      2   > 50U 7.7E-02  UG/CM2  DEAD/T 133.99

                                 WEIGHT DISTRIBUTION

             TYPE        .2-1.  1.-2.5  2.5-5.  5.-10  10-20   +20   TOTAL

            QUARTZ...      2     18      19      30     23      7    14.1

            KAOLINITE      1     10      24      47     13      5    12.3

            ILLITE...      5     34      22      21     15      4    11.0

            PYRITE...      0      0      13      28     33     26    24.5

            CALCITE..      0      0      22       0     40     38     2.2

            FE-SUL...      0      0       0      35     10     55     2.4

            MIXSIL...      7     32      16      18     22      5    13.6

            NOT-INT..      1     36      21       7     18     17    14.7

            UNKNOWN..      4     22       9       0     20     45     1.8

            MISC.....      8     14      31      28     19      0     3.4

            TOTAL....      2     18      18      24     22     15   100.0


                                   AVERAGE COMPOSITION
             TYPE         AVE     NA    MG    AL    SI    S    CL    P    K    CA   TI   FE     WT%
            QUARTZ...     2.37           0          94    1     0         1     0    0    1    14.1
            KAOLINITE     2.20     0          40    48    3     2         1     1    2    2    12.3
            ILLITE...     1.35     0          29    50    2     4    0   11     1    2    3    11.0
            CHAMOSITE     3.97           6    20    28    3     3                    3   39     0.3
            PYRITE...     6.27     0     0     3     2   62               0     1    1   32    24.5
            HALITE...     6.63    20                 2         76         1     1    0    2     1.1
            CALCITE..     7.04     0     0     4     1    2     2    2    1    87    0    1     2.2
            RUTILE...    19.76           1     1     4    1                         91    1     0.4
            MONTMORIL     1.12     2     0    14    68    5     2         3     2    3    2     0.7
            FE-SUL...    12.00     0     0     3     2   50               1     1    1   43     2.4
            QUARORG..     0.51           0     4    74   10     3         4     1    2    1     0.4
            QUARPYR..     1.39     0          37    42    8          1    6     1    1    4     0.1
            MIXSIL...     1.22     1     0    23    61    2     2         5     1    2    4    13.6
            UNKCHLOR.     3.85    15           1     4         72    1    2     3         2     0.4
            NOT-INT..     0.94     1     0    47    25    6     2    1    5     4    6   10    14.7
            UNKNOWN..     1.71     0     0    33    27    5     4         3     0   19    8     1.8
```

```
SAMPLE: PHALEN 268-05C       0.15 - 0.30 m

NUMBER     0  DISK   174    FILE 106 - 110  PARTICLES                        RUN/T  233.00

RUN        1  DATE  8/ 9/88  SUMMARY   109   TOTAL   598    MASS 1.4E+00  UG/CM2  ANAL./T 99.00

BLOCKS    30  TIME 11:24    OFF-PT.        > 50U      2   > 50U 7.7E-02  UG/CM2  DEAD/T 133.99

TABLE USED TO SCALE DATA

                      RUN PARAMETER TABLE
  MAG    BIN     XL      XU      PARTS  FIELDS  SCALE    MASS

  500     0     0.2     1.0       35   12.23      58  3.41E-02

  500     1     1.0     2.5      165   12.23      58  2.57E-01

  150     2     2.5     5.0      143    4.27      15  2.61E-01

  150     3     5.0    10.0       57    4.27      15  3.45E-01

   50     4    10.0    20.0      164    7.15       1  3.16E-01

   50     5    20.0    50.0       34    7.15       1  2.07E-01



                               SIZE DISTRIBUTION

    TYPE          .2-1.  1.-2.5   2.5-5.  5.-10  10-20    +20     PART/CM2   %TOTAL
   QUARTZ...        27      49      15      7      1      0      1.0E+04     7.7
   KAOLINITE        41      30      17     11      1      0      9.8E+03     7.2
   ILLITE...        56      35       7      2      0      0      2.3E+04    17.0
   CHAMOSITE         0       0      94      0      6      0      6.9E+01     0.1
   PYRITE...         0       0      56     32     10      2      1.4E+03     1.0
   HALITE...         0       0      33     67      0      0      1.9E+02     0.1
   CALCITE..         0       0      82      0     13      5      2.3E+02     0.2
   RUTILE...         0       0       0      0    100      0      4.8E+00     0.0
   MONTMORIL        84      10       5      0      0      0      2.4E+03     1.8
   FE-SUL...         0       0       0     75     10     15      8.7E+01     0.1
   QUARORG..        92       7       1      0      0      0      7.2E+03     5.3
   QUARPYR..         0      85      15      0      0      0      5.0E+02     0.4
   MIXSIL...        59      35       4      1      0      0      3.2E+04    23.9
   UNKCHLOR.         0       0     100      0      0      0      1.9E+02     0.1
   NOT-INT..        58      37       4      0      0      0      4.6E+04    33.9
   UNKNOWN..        28      58      12      0      1      0      1.7E+03     1.2

   TOTAL....        55      34       7      3      1      0      1.3E+05   100.0
```

```
SAMPLE: PHALEN 268-05D      0.30 - 0.45 m

NUMBER     1  DISK   173     FILE 115 - 119  PARTICLES                              RUN/T  145.99

RUN        1  DATE  8/ 4/88  SUMMARY   118   TOTAL   580     MASS 1.6E+00  UG/CM2   ANAL./T103.00

BLOCKS    30  TIME 14:22     OFF-PT.         > 50U     20    > 50U 1.3E+00  UG/CM2  DEAD/T  42.99

                                          WEIGHT DISTRIBUTION

            TYPE             0.2-1   1-2.5   2.5-5   5-10    10-20    +20   TOTAL

             QUARTZ...         1      12      44      20      17       6    12.1

             KAOLINITE         1       5      14      37      24      20    14.6

             ILLITE...         2      12      15      35      10      24    12.7

             PYRITE...         0       0       7      29      64       0     4.9

             CALCITE..         0       0       4      21      24      51    14.8

             MIXSIL...         2      11      19      20      12      37    20.7

             NOT-INT..         5      27      30      12      14      12    13.4

             UNKNOWN..         7      19       0      53      21       0     2.0

             MISC.....        14      16      16      12      13      30     4.7

             TOTAL....         2      11      19      24      19      25   100.0



                                             AVERAGE COMPOSITION
              TYPE          AVE       NA    MG    AL    SI     S    CL     P     K    CA    TI    FE   WT%
             QUARTZ...      1.11                   0    90     3                 2     0     1     4  12.1
             KAOLINITE      1.05       1          42    44     2     2           0     2     4     4  14.6
             ILLITE...      1.43       0     0    29    46     5     3          10     1     4     4  12.7
             CHAMOSITE      2.01       0     1    22    34     2     1     1     1     2     4    33   0.8
             PYRITE...      7.02                   2     1    64                       0     1    31   4.9
             CALCITE..      7.31             1     4     1     1     2     1     1    86     1     4  14.8
             MONTMORIL      1.03       1          12    72     5     3           2     2     2     3   0.5
             FE-SUL....    22.40                              57                 1     1          40   0.4
             QUARORG..      0.43       2          22    40    16     3           9     1     4         1.4
             QUARPYR..      1.04             1    25    40     8     4     0    10     2     5     4   0.8
             MIXSIL...      2.09                  22    57     3     2           6     2     2     8  20.7
             MIXSUL...     35.50                   6     3    29                 1    50          12   0.7
             NOT-INT..      0.68       1     2    13    50    13     8     1     7     3     4     2  13.4
             UNKNOWN..      1.41       0     2    38    31     5     5     1     3     4     2     8   2.0
```

```
SAMPLE: PHALEN 260-05D       0.30 - 0.45 m

NUMBER     1  DISK   173     FILE 115 - 119  PARTICLES                                    RUN/T  145.99

RUN        1  DATE  8/ 4/88  SUMMARY   118    TOTAL    580     MASS 1.6E+00  UG/CM2   ANAL./T103.00

BLOCKS    30  TIME 14:22     OFF-PT.        > 50U     20     > 50U 1.3E+00  UG/CM2   DEAD/T  42.99

TABLE USED TO SCALE DATA

                     RUN PARAMETER TABLE
    MAG     BIN     XL      XU     PARTS  FIELDS  SCALE     MASS

    500      0      0.2     1.0      49   15.62      32  3.76E-02

    500      1      1.0     2.5     151   15.62      32  1.73E-01

    150      2      2.5     5.0     144    3.22      14  3.02E-01

    150      3      5.0    10.0      56    3.22      14  3.09E-01

     50      4     10.0    20.0     132    5.14       1  3.03E-01

     50      5     20.0    50.0      48    5.14       1  3.97E-01



                                   SIZE DISTRIBUTION

    TYPE             0.2-1    1-2.5    2.5-5    5-10    10-20     +20     PART/CM2   %TOTAL
     QUARTZ...        70       14       14        2       0        0      2.5E+04    12.3
     KAOLINITE        80        7        6        5       1        0      2.2E+04    10.9
     ILLITE...        61       27        8        4       0        0      1.6E+04     8.3
     CHAMOSITE        60       27        0       12       2        0      7.4E+02     0.4
     PYRITE...         0        0       26       51      23        0      3.3E+02     0.2
     CALCITE..         0       16       20       46      13        5      1.3E+03     0.6
     MONTMORIL        70       26        4        0       0        0      2.2E+03     1.1
     FE-SUL...         0        0        0        0       0      100      6.5E+00     0.0
     QUARORG..        94        4        2        0       0        0      2.4E+04    11.9
     QUARPYR..        87        5        5        2       0        0      3.6E+03     1.8
     MIXSIL...        45       32       17        5       1        1      1.6E+04     8.3
     MIXSUL...         0        0        0        0       0      100      6.5E+00     0.0
     NOT-INT..        76       19        4        1       0        0      8.6E+04    42.3
     UNKNOWN..        69       27        0        4       1        0      3.9E+03     1.9

    TOTAL....         74       17        6        2       0        0      2.0E+05   100.0
```

```
SAMPLE: 268 05 COMP01       0.45 - 0.93 m

NUMBER     1  DISK   198    FILE 101 - 105  PARTICLES                          RUN/T  125.99

RUN        1  DATE  1/11/89  SUMMARY   104   TOTAL   565    MASS 3.5E+00  UG/CM2  ANAL./T124.99

BLOCKS    30  TIME 14:59     OFF-PT.        ) 50U     16    ) 50U 1.5E+00  UG/CM2  DEAD/T   1.00

                                     WEIGHT DISTRIBUTION

          TYPE           0.2-1   1-2.5   2.5-5    5-10   10-20     +20   TOTAL

          QUARTZ...          0       7      44      19      21       9     4.0

          KAOLINITE          3      29      34      24       5       5    10.5

          ILLITE...          2      15      35      40       3       5    12.3

          PYRITE...          0       7      11       0      25      57     8.1

          CALCITE..          0       0       0      58       0      35     3.3

          QUARORG..         24      13      37      25       1       0     2.7

          QUARPYR..         13       9      37      34       7       0     2.1

          MIXSIL...          6      36      22      21       7       9     9.3

          NOT-INT..          1      13      45      10       7      17    41.5

          UNKNOWN..          6       6      14      67       8       0     2.5

          MISC.....          0      10       9      57       5      11     3.0

          TOTAL....          3      16      34      25       8      15   100.0


                                       AVERAGE COMPOSITION
            TYPE          AVE     NA    MG    AL    SI     S    CL     P     K    CA    TI    FE    WT%
          QUARTZ...      3.53      0     1          92     1     2           2     0     0     1    4.0
          KAOLINITE      1.27      1          38    48     3     3           1     1     2     3   10.5
          ILLITE...      1.69      0          32    47     6     1           9     2     1     3   12.3
          ORGSULF..      3.06                  1     5    72                       1     1    21    0.1
          PYJAR....      2.93      0     0     8    13    52     1           3     1     1    21    1.3
          PYRITE...      2.86            0     2     2    66     1           0     0     1    27    8.1
          CALCITE..      7.20      1     0     1     4     2     2     1     2    86     2     2    3.3
          MONTMORIL      2.01      1          18    69     2     2           2     2     2     2    1.1
          FE-SUL...      8.81            1           4    41                       1          53    1.3
          QUARORG..      0.41      0          20    44    14     6     1     4     5     3     2    2.7
          QUARPYR..      0.61      0     0    22    41    15     5           3     2     3     8    2.1
          MIXSIL...      1.00            1    39    42     3     3           6     1     3     4    9.3
          NOT-INT..      1.45      2     4    17    34    13    12     4     6     8     5    10   41.5
          UNKNOWN..      1.51      1     2    26    40     4    11     0     3     3     6     4    2.5
```

```
SAMPLE: 268 05 COMP01    0.45 - 0.93 m

NUMBER      1  DISK   198    FILE 101 - 105  PARTICLES                              RUN/T  125.99

RUN         1  DATE  1/11/89  SUMMARY   104   TOTAL   565    MASS 3.5E+00  UG/CM2   ANAL./T124.99

BLOCKS     30  TIME 14:59    OFF-PT.        ) 50U     16    ) 50U 1.5E+00  UG/CM2   DEAD/T   1.00

TABLE USED TO SCALE DATA

                     RUN PARAMETER TABLE
 MAG    BIN     XL      XU      PARTS  FIELDS  SCALE    MASS

  500     0     0.2     1.0      37    5.00     114  8.84E-02

 500    1     1.0     2.5     144    5.00     114  5.34E-01

  150     2     2.5     5.0     160    0.93      54  1.14E+00

 150    3     5.0    10.0     40    0.93      54  8.39E-01

   50     4    10.0    20.0     129    5.71       1  2.79E-01

  50    5   20.0    50.0     55    5.71       1  5.27E-01



                                 SIZE DISTRIBUTION

 TYPE            0.2-1   1-2.5   2.5-5   5-10    10-20    +20     PART/CM2  %TOTAL
  QUARTZ...         0      28      63      7       2       0      4.3E+03    0.9
  KAOLINITE        56      33       9      2       0       0      5.3E+04   11.1
  ILLITE...        51      25      18      6       0       0      4.0E+04    8.4
  ORGSULF..         0       0     100      0       0       0      2.9E+02    0.1
  PYJAR....         0      46      33     21       0       0      1.4E+03    0.3
  PYRITE...         0      63      32      0       3       2      2.9E+03    0.6
  CALCITE..         0       0       0     95       2       3      9.3E+02    0.2
  MONTMORIL         0      92       0      8       0       0      3.7E+03    0.8
  FE-SUL...         0       0       0     96       2       2      3.0E+02    0.1
  QUARORG..        96       2       1      0       0       0      1.1E+05   22.7
  QUARPYR..        93       2       4      1       0       0      3.2E+04    6.6
  MIXSIL...        67      26       6      1       0       0      7.0E+04   14.5
  NOT-INT..        49      30      17      3       0       0      1.5E+05   32.3
  UNKNOWN..        69      16       8      8       0       0      7.8E+03    1.6

TOTAL....       65      22      10       2       0       0     4.8E+05   100.0
```

```
SAMPLE: 268 05 COMP02       0.93 - 2.13 m

NUMBER     1  DISK   198     FILE 106 - 110  PARTICLES                       RUN/T  !05.00

RUN        1  DATE  1/12/89  SUMMARY   109   TOTAL   589     MASS 1.4E+00  UG/CM2   ANAL./T!91.00

BLOCKS    30  TIME  9:44     OFF-PT.         ) 50U     10    ) 50U 1.1E+00  UG/CM2   DEAD/T  14.00

                                        WEIGHT DISTRIBUTION

             TYPE            0.2-1   1-2.5   2.5-5   5-10    10-20    +20   TOTAL

              QUARTZ...          1      19      19     33       22      7     6.3

              KAOLINITE          3      15       9      9       41     23     8.8

              ILLITE...         11      47      16     13       14      0     3.3

              PYRITE...          0      13      33     14       30     10    11.9

              CALCITE..          0       0       9     40       27     24    21.3

              MIXSIL...          6      13       4      1       14     62    15.6

              NOT-INT..          3      21      11      8       10     47    23.0

              UNKNOWN..          4       4      21     47       17      8     5.1

              MISC.....         15      16       9     16       31     12     4.6

              TOTAL....          3      14      13     18       22     30   100.0



                                          AVERAGE COMPOSITION
               TYPE        AVE       NA     MG     AL     SI      S     CL      P      K     CA     TI     FE    WT%
              QUARTZ...    2.46              0      1     93      2      1             0      1      1      1     6.3
              KAOLINITE    1.26              0     42     45      5      2             2      2      2      2     8.8
              ILLITE...    0.97       0            31     46      2      2            11      1      1      5     3.3
              CHAMOSITE    4.97                    20     26      5      6                    3             40     0.2
              PYJAR....    2.12       1             5      0     60      2             3      1      1     28     0.5
              PYRITE...    3.45       0      0      2      2     66                    0      0      1     28    !!.9
              SIDERITE.    2.92       1             7                   15                                  77     0.1
              CALCITE..    6.78              1      2      2      2      2      1      1     87      2      2    21.3
              MONTMORIL    0.52       1            15     61      7      2             5      2      1      5     0.1
              FE-SUL...   16.25       0      1      2      2     42      1             1      0      3     49     0.6
              QUARORG..    0.54       1            28     38     14      6             6      4      1      3     1.1
              QUARPYR..    1.13       1      1     38     25     13      5      0      4      0      3      9     1.3
              MIXSIL...    0.66       1            30     50      2      4      0      4      3      1      5    15.6
              MIXSUL...   14.06              1      1      1     56      1             2     16            23     0.2
              UNKCHLOR.    0.48       1            13      8      0     71             2      2      1      2     0.6
              NOT-INT..    1.16       2      2     28     30     10     17      2      6      8      4      7    23.0
              UNKNOWN..    2.31       0      0     52      8      2     20      0      2      9      3      5     5.1
```

```
SAMPLE: 260 05 COMP02      0.93 - 2.13 m

NUMBER      1  DISK   198     FILE 106 - 110  PARTICLES                             RUN/T  !05.00

RUN         1  DATE  1/12/89  SUMMARY   109   TOTAL   589     MASS 1.4E+00  UG/CM2  ANAL./T!91.00

BLOCKS     30  TIME  9:44     OFF-PT.         ) 50U     10   ) 50U 1.1E+00  UG/CM2  DEAD/T  14.00

TABLE USED TO SCALE DATA

                        RUN PARAMETER TABLE
MAG     BIN      XL      XU      PARTS  FIELDS  SCALE     MASS

  500     0     0.2     1.0       53   14.00       36  4.52E-02

 500      1     1.0     2.5      146   14.00      36  1.94E-01

  150     2     2.5     5.0      132    5.78       8  1.06E-01

 150      3     5.0    10.0       68    5.78       8  2.63E-01

   50     4    10.0    20.0      137    5.16       1  3.11E-01

  50      5    20.0    50.0       53    5.16       1  4.33E-01



                              SIZE DISTRIBUTION

TYPE              0.2-1   1-2.5   2.5-5   5-10    10-20    +20       PART/CM2   %TOTAL
 QUARTZ...          11      63      16      8       1       0        4.5E+03     2.9
 KAOLINITE          67      26       4      1       1       0        1.3E+04     8.3
 ILLITE...          72      25       2      1       0       0        1.5E+04     9.9
 CHAMOSITE           0       0     100      0       0       0        4.8E+01     0.0
 PYJAR....           0      80      17      0       2       0        2.7E+02     0.2
 PYRITE...           0      53      37      6       3       0        2.4E+03     1.6
 SIDERITE.           0       0     100      0       0       0        4.8E+01     0.0
 CALCITE..           0       0      40     48      10       2        2.6E+03     1.7
 MONTMORIL         100       0       0      0       0       0        1.7E+03     1.1
 FE-SUL...           0       0       0      0      67      33        1.8E+01     0.0
 QUARORG..          93       6       0      0       0       0        1.3E+04     8.8
 QUARPYR..          69      29       0      0       1       0        3.2E+03     2.0
 MIXSIL...          86      13       1      0       0       0        4.3E+04    27.9
 MIXSUL...           0       0       0      0     100       0        6.4E+00     0.0
 UNKCHLOR.          98       0       0      2       0       0        7.6E+03     4.8
 NOT-INT..          52      42       4      1       0       0        4.4E+04    28.1
 UNKNOWN..          57      12      18     12       1       0        3.9E+03     2.5

 TOTAL....          69      24       4      2       1       0        1.5E+05   100.0
```

```
SAMPLE: PHALEN 268-05Q        2.13 - 2.28 m

NUMBER     1  DISK   174     FILE 101 - 105  PARTICLES                              RUN/T  116.00

RUN        1  DATE  8/ 9/88  SUMMARY   104   TOTAL   598     MASS 3.2E+00  UG/CM2   ANAL./T 89.00

BLOCKS    30  TIME  8:55     OFF-PT.        ) 50U      2   ) 50U 1.0E-01  UG/CM2   DEAD/T  27.00

                                          WEIGHT DISTRIBUTION

              TYPE             0.2-1   1-2.5   2.5-5   5-10    10-20    +20   TOTAL

               QUARTZ...         0       4       42     48       2       3     9.5

               KAOLINITE         0       0       12     73      12       3    10.1

               PYJAR....         2      44       36     18       0       0     1.5

               PYRITE...         1      10        6     17      42      24    41.6

               HALITE...         0       0        3      0      32      66     2.4

               CALCITE..         0       0        6     36      21      37    11.0

               QUARORG..         6       5       27     53       9       0     2.9

               MIXSIL...         1       2        6     44      22      26     6.5

               MIXSUL...         2       3        0      0      95       0     1.9

               NOT-INT..         5      27       19     11      25      13     2.8

               UNKNOWN..         1       3       32     10      35      19     5.5

               MISC.....         2       8       37     13      41       0     4.3

               TOTAL....         1       7       14     29      30      19   100.0


                                          AVERAGE COMPOSITION
                TYPE           AVE      NA    MG    AL    SI     S    CL     P     K    CA    TI    FE   WT%
               QUARTZ...      3.43       0     1     1    92     2     2           2     1           1   9.5
               KAOLINITE      6.05       1          43    48     2     4           1     2     1     2  10.1
               ILLITE...      3.46       0          32    43     4     2          13     2     2     2   1.2
               ORGSULF..      1.72             0     2     4    75     1                 0          17   0.2
               PYJAR....      1.66       1     1     4     4    60     1           4     1     2    26   1.5
               PYRITE...      2.72             1     4     2    62                 0     1     2    30  41.6
               HALITE...     11.72      12           5     5          74     0     1     2     1     2   2.4
               CALCITE..      7.02       0     0     6     1     2     1     1     1    85     1     2  11.0
               FE-SUL...     15.31       1     1     4     2    50                 1     2     1    40   0.8
               QUARORG..      0.92       0          40    28    16     4     0     4     2     4     3   2.9
               QUARPYR..      0.37                  48    19    14     3           3     5           8   1.3
               MIXSIL...      4.22       1          31    54     3     3           2     3     2     2   6.5
               MIXSUL...      1.37       0     1     6     0    51     1     1     3    14     1    20   1.9
               UNKCHLOR.      0.33       2     4     1     1     1    85           3     2     2     1   0.5
               APATITE..      3.11             1     2                 1    27          65     2     2   0.2
               NOT-INT..      0.93       1     1    49     9    10    12     2     2     9     2     6   2.8
               UNKNOWN..      0.68       4          36     2    15    27     3     3     4     2     5   5.5
```

```
SAMPLE: PHALEN 260-050        2.13 - 2.28 m

NUMBER     1  DISK   174     FILE 101 - 105  PARTICLES                            RUN/T  116.00

RUN        1  DATE  8/ 9/88  SUMMARY   104   TOTAL   598     MASS 3.2E+00  UG/CM2   ANAL./T 89.00

BLOCKS    30  TIME  8:55     OFF-PT.        ) 50U      2   ) 50U 1.8E-01  UG/CM2   DEAD/T  27.00

TABLE USED TO SCALE DATA

                      RUN PARAMETER TABLE
  MAG     BIN     XL      XU      PARTS  FIELDS   SCALE     MASS

  500      0      0.2     1.0       41   20.79       12  2.87E-02

  500      1      1.0     2.5      159   20.79       12  2.15E-01

  150      2      2.5     5.0      123    2.19       10  4.42E-01

  150      3      5.0    10.0       77    2.19       10  9.15E-01

   50      4     10.0    20.0      162    2.54        1  9.45E-01

   50      5     20.0    50.0       36    2.54        1  6.14E-01




                                      SIZE DISTRIBUTION

  TYPE             0.2-1   1-2.5    2.5-5   5-10     10-20     +20      PART/CM2   %TOTAL
   QUARTZ...         15      20       48     17         0        0      9.5E+03      5.9
   KAOLINITE          0       3       25     70         2        0      4.5E+03      2.8
   ILLITE...          0      21       77      0         2        0      1.5E+03      0.9
   ORGSULF..         50      35       15      0         0        0      8.5E+02      0.5
   PYJAR....         14      71       12      3         0        0      4.2E+03      2.7
   PYRITE...         24      54       10      6         5        1      1.9E+04     12.3
   HALITE...          0       0       45      0        33       22      2.8E+02      0.2
   CALCITE..          0       6       35     47         9        3      2.7E+03      1.7
   FE-SUL...          0       0        0      0       100        0      6.4E+01      0.0
   QUARORG..         83       6        8      3         0        0      1.7E+04     10.6
   QUARPYR..         95       2        1      1         0        0      2.6E+04     16.5
   MIXSIL...         24      23       17     32         4        1      3.1E+03      2.0
   MIXSUL...         85       9        0      0         6        0      3.3E+03      2.0
   UNKCHLOR.         97       2        1      0         0        0      1.5E+04      9.3
   APATITE..          0      86        0      0        14        0      1.7E+02      0.1
   NOT-INT..         63      31        5      1         0        0      2.1E+04     13.4
   UNKNOWN..         89       2        7      1         1        0      3.0E+04     19.1

   TOTAL....         66      17       10      6         1        0      1.6E+05    100.0
```

X

```
SAMPLE: PHALEN 268-05-R          2.28 - 2.48 m

NUMBER     1  DISK   180    FILE 101 - 104  PARTICLES                         RUN/T   61.00

RUN        1  DATE  8/22/88  SUMMARY   103  TOTAL   473    MASS 9.4E+00  UG/CM2  ANAL./T 57.99

BLOCKS    24  TIME  9:48    OFF-PT.       ) 50U      6   ) 50U 3.6E-01  UG/CM2  DEAD/T   3.00

                                    WEIGHT DISTRIBUTION

            TYPE         .2-1.  1.-2.5  2.5-5.  5.-10  10-20   +20    TOTAL

            QUARTZ...      0      7       0      16      9     69      1.6

            KAOLINITE      0      0       0      89     11      0      1.9

            PYJAR....      0      1      82      16      0      0      7.9

            PYRITE...      0      2      48      42      5      3     74.9

            CALCITE..      0      0       0       0     29     71      4.7

            MIXSIL...      0      1       7       0      8     84      1.9

            NOT-INT..      0      0      97       0      3      0      2.4

            MISC.....      1      1      33      43      9     13      4.7

            TOTAL....      0      1      46      37      6      9    100.0



                                   AVERAGE COMPOSITION
           TYPE          AVE     NA    MG    AL    SI     S    CL     P     K    CA    TI    FE     WT%
           QUARTZ...     3.66                      94     2     1           1     1     0     1     1.6
           KAOLINITE     6.73     1          42    49     2     2           2     1     1     2     1.9
           ILLITE...     7.85     0          33    52     2     1           9     2     2     0     0.5
           ORGSULF..     3.74     1     1     4     2    65     3           1     4     2    18     1.0
           PYJAR....     3.47     2     1     3     4    61     2           4     0     2    24     7.9
           PYRITE...     4.39     1     1     2     2    63                 0     0     1    31    74.9
           CALCITE..    13.08                 4     1     2     1     2     1    89     1     2     4.7
           FE-SUL...     8.49     0           2     1    51                 1     1     1    44     1.3
           QUARORG..     2.80     0     0    26    37    22     2           3     2     3     6     0.8
           QUARPYR..     2.52     1     0    12     4    55     2                 1     3    22     0.5
           MIXSIL...     4.29     0          35    54     4     1           1     2     2     2     1.9
           MIXSUL...     3.30           2     8     6    46     6           4    12     1    16     0.2
           APATITE..    27.01           2     1           1     2    25     1    66     5     0     0.3
           NOT-INT..     3.15     1     1    10     4    50     3           3     3     4    23     2.4
           UNKNOWN..     1.69     1     0    12    11     9     9     8     3    29     1    18     0.3
```

```
SAMPLE: PHALEN 268-05-R        2.28 - 2.48 m

NUMBER     1  DISK   180     FILE 101 - 104  PARTICLES                                    RUN/T   61.00

RUN        1  DATE  8/22/88  SUMMARY   103   TOTAL   473    MASS 9.4E+00  UG/CM2  ANAL./T 57.99

BLOCKS    24  TIME  9:48     OFF-PT.       ) 50U      6   ) 50U 3.6E-01  UG/CM2  DEAD/T   3.00

TABLE USED TO SCALE DATA

                  RUN PARAMETER TABLE
  MAG    BIN     XL     XU     PARTS  FIELDS  SCALE     MASS

  500     0     0.2    1.0       10   20.00      19  7.82E-03

  500     1     1.0    2.5       69   20.00      19  1.30E-01

  150     2     2.5    5.0      153    0.51      67  4.23E+00

  150     3     5.0   10.0       47    0.51      67  3.38E+00

   50     4    10.0   20.0      139    3.89       1  5.91E-01

   50     5    20.0   50.0       55    3.89       1  8.22E-01



                              SIZE DISTRIBUTION

  TYPE          .2-1.  1.-2.5   2.5-5.   5.-10  10-20    +20     PART/CM2  %TOTAL
  QUARTZ...       0      68       0       28      2       2      1.9E+03    1.5
  KAOLINITE       0       7       0       91      3       0      2.3E+03    1.9
  ILLITE...       0       0       0       99      1       0      5.4E+02    0.4
  ORGSULF..       0       0     100        0      0       0      4.2E+03    3.4
  PYJAR....       2       7      82        9      0       0      1.8E+04   14.6
  PYRITE...       2      10      64       24      1       0      7.9E+04   63.0
  CALCITE..       0      33       0        0     43      23      8.2E+02    0.7
  FE-SUL...       0       0       0       88      9       3      6.0E+02    0.5
  QUARORG..      30      16      36       18      0       0      2.9E+03    2.4
  QUARPYR..      48       0      26       26      0       0      2.0E+03    1.6
  MIXSIL...      37      12      43        0      3       6      1.2E+03    1.0
  MIXSUL...       0      23      74        0      3       0      7.2E+02    0.6
  APATITE..       0       0       0        0      0     100      1.6E+01    0.0
  NOT-INT..       0       0     100        0      0       0      9.1E+03    7.3
  UNKNOWN..      75      21       0        0      3       1      1.4E+03    1.2

  TOTAL....       4       9      65       20      1       0      1.2E+05  100.0
```

```
SAMPLE: PHALEN 268-05T     2.53 - 2.73 m

NUMBER     1  DISK   173    FILE 120 - 124  PARTICLES                          RUN/T  207.99

RUN        1  DATE  8/ 8/86  SUMMARY   123   TOTAL   600    MASS 6.0E+00  UG/CM2  ANAL./T154.99

BLOCKS    30  TIME 13: 7     OFF-PT.        ) 50U     0    ) 50U 0.0E+00  UG/CM2  DEAD/T  53.00

                                  WEIGHT DISTRIBUTION

            TYPE          .2-1.  1.-2.5   2.5-5.   5.-10  10-20    +20    TOTAL

            KAOLINITE        0      5       21       63     12      0       2.0

            ILLITE...        0      0       34       61      6      0       1.6

            PYJAR....       11     46       29        0     14      0       2.0

            PYRITE...        0      7       15       23     38     17      76.6

            FE-SUL...        0      0        0        5     35     60      10.2

            NOT-INT..        4     24       39       28      6      0       3.2

            MISC.....        4     12       25       14     36     10       4.3

            TOTAL....        1      8       15       22     35     19     100.0



                                     AVERAGE COMPOSITION
             TYPE          AVE     NA    MG    AL    SI     S    CL     P     K    CA    TI    FE     WTX
            QUARTZ...     4.93      0     1          92     5     0           0     0     1     0     0.7
            KAOLINITE     4.49      0          41    46     5     2           2     1     2     2     2.0
            ILLITE...     5.39      1          30    46     6     2          10     1     2     3     1.6
            ORGSULF..     0.76      1     1     7     4    65     2           0     0     2    19     0.1
            PYJAR....     1.44      1     1     3     4    60     1           3     2     2    25     2.0
            PYRITE...     3.22      0           2     2    62                 0     1     1    31    76.6
            CALCITE..    27.24                  3     1                             93           3     0.4
            FE-SUL...    13.16            0     3     2    49                 1     1     1    44    10.2
            QUARORG..     1.48      1     0     9    55    22     3           2     3     2     4     0.7
            QUARPYR..     1.61            0    27    28    24     2           1     3     3    12     0.3
            MIXSIL...     3.67      0     1    25    60     4     2           4     1     2     2     1.3
            MIXSUL...     0.23      2          14          44     2     1     0    16     4    16     0.1
            APATITE..     3.53      0     1     2     0     4     1    19     2    66     1     4     0.5
            NOT-INT..     0.92      0     0    27    12    38     4     2     4     4     1     9     3.2
            UNKNOWN..     1.24      0     1    11           6     5    16     0    57     1     2     0.2
```

```
SAMPLE: PHALEN 268-05T      2.53 - 2.73 m

NUMBER      1  DISK   173     FILE 120 - 124  PARTICLES                                  RUN/T  207.99

RUN         1  DATE  8/ 8/88  SUMMARY   123   TOTAL   600     MASS 6.0E+00  UG/CM2   ANAL./T154.99

BLOCKS     30  TIME 13: 7     OFF-PT.        ) 50U      0    ) 50U 0.0E+00  UG/CM2   DEAD/T  53.00

TABLE USED TO SCALE DATA

                      RUN PARAMETER TABLE
   MAG     BIN     XL      XU      PARTS  FIELDS  SCALE    MASS

   500      0      0.2     1.0       31   12.49     11   3.76E-02

   500      1      1.0     2.5      169   12.49     11   4.61E-01

   150      2      2.5     5.0      140    1.65      8   9.10E-01

   150      3      5.0    10.0       60    1.65      8   1.30E+00

    50      4     10.0    20.0      164    1.48      1   2.06E+00

    50      5     20.0    50.0       36    1.48      1   1.15E+00



                           SIZE DISTRIBUTION

   TYPE           .2-1.   1.-2.5   2.5-5.   5.-10   10-20    +20      PART/CM2   %TOTAL
  QUARTZ...          0        0       71      24       6      0       7.1E+02      0.4
  KAOLINITE          0       30       34      34       2      0       2.4E+03      1.4
  ILLITE...          0        0       54      43       2      0       1.5E+03      0.9
  ORGSULF..         82       14        4       0       0      0       4.4E+03      2.6
  PYJAR....         52       38        9       0       0      0       1.3E+04      7.6
  PYRITE...         17       41       25      11       5      1       6.0E+04     34.7
  CALCITE..          0        0        0       0       0    100       2.1E+01      0.0
  FE-SUL...          0       19        0      25      35     21       1.3E+03      0.8
  QUARORG..         50       29       21       0       0      0       5.8E+03      3.4
  QUARPYR..         40       53        6       0       1      0       2.7E+03      1.6
  MIXSIL...          0       46       27      23       4      0       2.1E+03      1.2
  MIXSUL...        100        0        0       0       0      0       2.9E+04     16.9
  APATITE..          0       58       30       0      12      0       5.5E+02      0.3
  NOT-INT..         71       19        8       1       0      0       4.6E+04     27.0
  UNKNOWN..         87       12        0       0       1      0       1.9E+03      1.1

  TOTAL....         51       26       14       6       2      0       1.7E+05    100.0
```

6. Phalen Seam - Phalen Colliery

Sandstone Roof

```
SAMPLE: PHALEN 268 06A       0.00 - 0.15 m

NUMBER     1  DISK   196     FILE 120 - 124  PARTICLES                    RUN/T   96.00

RUN        1  DATE  1/ 9/89  SUMMARY   123   TOTAL   590   MASS 2.8E+00  UG/CM2  ANAL./T 93.00

BLOCKS    30  TIME  9:54     OFF-PT.       > 50U     10   > 50U 1.7E+00  UG/CM2  DEAD/T   2.99

                              WEIGHT DISTRIBUTION

          TYPE        0.2-1  1-2.5  2.5-5   5-10  10-20    +20  TOTAL

           QUARTZ...      1     11     15     28     29     16    2.8

           KAOLINITE      1     12     20     35     21     12    4.4

           ILLITE...      3     10     21     30     11     25   13.3

           PYRITE...      0      0      4      7     19     70   50.4

           FE-SUL...      0      0      4      0     29     67    3.3

           MIXSIL...      3     14     15     29     10     20   12.2

           NOT-INT..      0     20      4      7      8     61    7.5

           UNKNOWN..      9     22     12      9      6     42    2.3

           MISC.....      4     14     23     32     27      0    3.8

           TOTAL....      1      6      9     15     17     51  100.0



                                  AVERAGE COMPOSITION
  TYPE          AVE   NA   MG   AL   SI    S   CL    P    K   CA   TI   FE   WT%
QUARTZ...      2.47                1   92    1              2    0    1    2   2.8
KAOLINITE      2.95    1          41   48    4    2         2    2    2    2   4.4
ILLITE...      0.90    1          26   48    5    1        13    3    1    5  13.3
PYJAR....      4.72    0    0    4    5   56              4         3   28   0.4
PYRITE...      9.59    0    0    1    1   62                   1    1   34  50.4
SIDERITE.     14.49    0    2    1    2   12              2    0    3   79   0.6
RUTILE...      4.09                4    8    2    1         3    2   81        0.1
MONTMORIL      3.78    0          17   70    1    1         2    2    4    2   0.6
FE-SUL...      9.63    0    1    2    2   47    1         1    1    1   48   3.3
QUARORG..      1.25    1          50   26   10    6         4    2    2    1   0.6
QUARPYR..      1.64    1          32   26   22    1         5    0    1   12   0.4
MIXSIL...      1.03    0    1   20   59    2    1        10    2    2    3  12.2
MIXSUL...     14.50                         57                   9    1   32   0.1
UNKCHLOR.      0.87    2          22    7        55         3    8    1    4   0.1
APATITE..      6.49    1           4         1    1   23        70    1    1   0.9
NOT-INT..      1.69    0    1   23   36    6    5    2   13    4    5   11   7.5
UNKNOWN..      0.75    0          40   11    7   10    3    4   13    7    7   2.3
```

```
SAMPLE: PHALEN 268 06A    0.00 - 0.15 m

NUMBER     1  DISK   196    FILE 120 - 124  PARTICLES                              RUN/T   96.00

RUN        1  DATE  1/ 9/89  SUMMARY   123  TOTAL   590    MASS 2.8E+00  UG/CM2   ANAL./T 93.00

BLOCKS    30  TIME  9:54    OFF-PT.       ) 50U     10   ) 50U 1.7E+00  UG/CM2   DEAD/T   2.99

TABLE USED TO SCALE DATA

                       RUN PARAMETER TABLE
   MAG     BIN      XL       XU      PARTS  FIELDS  SCALE    MASS

   500      0      0.2      1.0        42   15.60      27  3.22E-02

   500      1      1.0      2.5       158   15.60      27  1.81E-01

   150      2      2.5      5.0       134    3.60      10  2.64E-01

   150      3      5.0     10.0        66    3.60      10  4.33E-01

    50      4     10.0     20.0       113    4.25       1  4.72E-01

    50      5     20.0     50.0        77    4.25       1  1.42E+00



                              SIZE DISTRIBUTION

  TYPE
                0.2-1   1-2.5   2.5-5   5-10    10-20   +20     PART/CM2  %TOTAL
   QUARTZ...     38      37      23      7       2      0      3.2E+03    2.2
   KAOLINITE     10      49      27     12       2      0      5.1E+03    3.4
   ILLITE...     76      14       6      3       0      0      5.6E+04   37.6
   PYJAR....      0       0      48     48       4      0      1.6E+02    0.1
   PYRITE...      0       0      43     28      15     14      2.2E+03    1.5
   SIDERITE.      0       0       0      0     100      0      2.9E+01    0.0
   RUTILE...      0       0     100      0       0      0      7.7E+01    0.1
   MONTMORIL      0      38      46     15       1      0      5.1E+02    0.3
   FE-SUL...      0       0      65      0      22     12      2.3E+02    0.2
   QUARORG..     48      48       4      0       0      0      4.0E+03    2.7
   QUARPYR..     52      21      26      0       1      0      1.2E+03    0.8
   MIXSIL...     72      19       6      3       0      0      4.7E+04   31.1
   MIXSUL...      0       0       0      0     100      0      7.7E+00    0.0
   UNKCHLOR.     87      13       0      0       0      0      1.5E+03    1.0
   APATITE..      0       0      35     60       6      0      2.5E+02    0.2
   NOT-INT..     12      82       4      1       0      1      1.2E+04    8.4
   UNKNOWN..     83      15       1      0       0      0      1.5E+04   10.5

   TOTAL....     64      24       7      3       1      0      1.5E+05  100.0
```

```
SAMPLE: PHALEN 268 068        0.15 - 0.30 m

NUMBER     1  DISK   197    FILE 101 - 105  PARTICLES                             RUN/T  211.00

RUN        1  DATE  1/ 9/89  SUMMARY   104   TOTAL   582    MASS 3.0E+00  UG/CM2  ANAL./T211.00

BLOCKS    30  TIME 13:38     OFF-PT.        ) 50U     18    ) 50U 2.1E+00  UG/CM2  DEAD/T   0.00

                                    WEIGHT DISTRIBUTION

              TYPE         0.2-1   1-2.5   2.5-5   5-10    10-20    +20   TOTAL

               QUARTZ...      2      16      22      21      19      20     4.8

               KAOLINITE      3      17      42      13      15      10     4.5

               ILLITE...      5      14      31      43       7       0     8.3

               PYRITE...      0       0       8      48      13      31    57.3

               FE-SUL...      0       0       0       0       9      91     3.7

               MIXSIL...      5      24      20      18      18      14     9.2

               NOT-INT..      1      51      38       3       2       5     7.0

               MISC.....      9      15      36       7       7      27     5.1

               TOTAL....      2       9      17      35      12      25   100.0



                                      AVERAGE COMPOSITION
             TYPE          AVE      NA    MG    AL    SI     S    CL     P     K    CA    TI    FE   WT%
             QUARTZ...     2.02      1           2    90     2     1           1     1     1     1   4.8
             KAOLINITE     1.68                 39    45     5     2           2     2     2     3   4.5
             ILLITE...     1.11      1          30    50     4     2           9     1     2     2   8.3
             PYJAR....     2.93      0     0     5     4    58                 3     0     0    28   0.7
             PYRITE...     6.01      0     1     1     2    62                 1     1     1    34  57.3
             CALCITE..    23.72      1     1     2     2     0     1     1     0    91     1     2   0.9
             RUTILE...     2.22            1     3     7     0     1           1     1    86     0   0.3
             MONTMORIL     1.33      2          18    64     5     4           2     1     2     3   1.3
             FE-SUL...    27.47      0     0     0     1    55                 1     1     1    41   3.7
             QUARORG..     0.42                 25    50     9     3          10     2     0     2   0.5
             QUARPYR..     0.81      2     0    26    41    14     1           4     1     3     8   0.3
             MIXSIL...     0.99      1     0    24    57     4     1           6     2     2     4   9.2
             NOT-INT..     1.00      1     2    21    50     6     1     1     4     6     5     6   7.0
             UNKNOWN..     1.20      0     0    31    22     7     4     1     4     2    27     2   1.1
```

```
SAMPLE: PHALEN 268 068       0.15 - 0.30 m

NUMBER     1  DISK   197    FILE 101 - 105  PARTICLES                         RUN/T  211.00

RUN        1  DATE  1/ 9/89 SUMMARY   104   TOTAL   502     MASS 3.0E+00  UG/CM2  ANAL./T211.00

BLOCKS    30  TIME 13:38    OFF-PT.        ) 50U     18   ) 50U 2.1E+00  UG/CM2  DEAD/T   0.00

TABLE USED TO SCALE DATA

                   RUN PARAMETER TABLE
  MAG    BIN     XL      XU     PARTS  FIELDS  SCALE    MASS

  500     0     0.2     1.0      40   10.08      60  4.74E-02

  500     1     1.0     2.5     160   10.08      60  2.74E-01

  150     2     2.5     5.0     143    2.22      24  4.95E-01

  150     3     5.0    10.0      57    2.22      24  1.02E+00

   50     4    10.0    20.0     121    6.06       1  3.59E-01

   50     5    20.0    50.0      61    6.06       1  7.49E-01



                                  SIZE DISTRIBUTION

  TYPE           0.2-1   1-2.5   2.5-5   5-10   10-20    +20      PART/CM2  %TOTAL
   QUARTZ...       35      43      15      6       1      0       8.9E+03     4.0
   KAOLINITE       44      33      21      2       0      0       1.3E+04     6.1
   ILLITE...       74      15       8      3       0      0       4.1E+04    18.4
   PYJAR....        0      37      63      0       0      0       8.2E+02     0.4
   PYRITE...        0       4      41     50       3      2       7.7E+03     3.5
   CALCITE..        0       0       0      0      40     60       2.5E+01     0.0
   RUTILE...        0      70      29      0       1      0       4.3E+02     0.2
   MONTMORIL       65      18      14      3       0      0       4.4E+03     2.0
   FE-SUL...        0       0       0      0      34     66       6.1E+01     0.0
   QUARORG..       96       2       2      0       0      0       2.0E+04     9.0
   QUARPYR..       82      16       2      0       0      0       6.7E+03     3.0
   MIXSIL...       73      19       5      2       0      0       5.2E+04    23.6
   NOT-INT..       44      49       6      0       0      0       6.1E+04    27.4
   UNKNOWN..       56      39       5      0       0      0       5.3E+03     2.4

   TOTAL....       61      27       9      3       0      0       2.2E+05   100.0
```

```
SAMPLE: PHALEN 260 06C        0.30 - 0.45 m

NUMBER     1  DISK   197     FILE 106 - 110  PARTICLES                        RUN/T   90.00

RUN        1  DATE  1/ 9/89  SUMMARY   109   TOTAL   479      MASS 2.0E+00  UG/CM2  ANAL./T 77.00

BLOCKS    25  TIME 15: 8     OFF-PT.        > 50U      8   > 50U 3.6E-01  UG/CM2  DEAD/T  13.00

                                 WEIGHT DISTRIBUTION

          TYPE          0.2-1   1-2.5   2.5-5   5-10    10-20    +20   TOTAL

           KAOLINITE       0       3      17      46      20      13     6.8

           PYRITE...       0       3      27       4      14      52    73.4

           HALITE...       0       0       2      98       0       0     1.9

           FE-SUL...       0       3       4       0       7      85     3.3

           MIXSIL...       5      21      19      38       9       7     2.4

           UNKCHLOR.       0       0      16      84       0       0     1.8

           NOT-INT..       1      14      27      27      12      19     4.1

           MISC.....       4      12      22      22      19      22     6.3

           TOTAL....       1       4      24      13      13      44   100.0


                                  AVERAGE COMPOSITION
          TYPE         AVE      NA   MG   AL   SI    S   CL    P    K   CA   TI   FE   WT%
          QUARTZ...    2.17      0    1    1   91    2    1         1    0    2    2   1.1
          KAOLINITE    4.30      0        41   50    2    1         2    1    3    2   6.8
          ILLITE...    1.68      1        32   46    4    2    0   10    1    2    3   0.7
          ORGSULF..    1.05                         81                        1   18   0.0
          PYJAR....    2.22      0    1    1    2   63              3    2    0   27   0.7
          PYRITE...    3.75      0         0    2   63              1    0    1   34  73.4
          HALITE...    6.69     14         3    3    2   71         1    4    2    2   1.9
          SIDERITE.    7.37           1    2    6         6         2    2    2   81   1.0
          RUTILE...    3.35                     4    2    3         1    1   86    3   0.1
          MONTMORIL    2.06      1        10   79    4              1    3         3   0.1
          FE-SUL...    6.53           0    2    2   48    0         1    1    1   45   3.3
          QUARORG..    0.92               38   34   12    2         8    4    0    2   0.3
          QUARPYR..    1.26      1        25   37   14              0    5    3    8   0.4
          MIXSIL...    1.78      1    0   30   54    4    1         4    2    2    3   2.4
          MIXSUL...    4.77      3    1    6    6   42    7         1   25    2    0   0.4
          UNKCHLOR.    5.72      3    1    6    5    5   70    1    2    7    1    4   1.8
          APATITE..   19.22      0         1         1    1   22    1   73         1   0.5
          NOT-INT..    1.54      2    0   40   23    4   11    0    6    4    4    7   4.1
          UNKNOWN..    0.54      7    0   18   35    4   18         6    3    5    3   1.0
```

```
SAMPLE: PHALEN 268 06C       0.30 - 0.45 m

NUMBER      1  DISK   197    FILE 106 - 110  PARTICLES                               RUN/T    90.00

RUN         1  DATE  1/ 9/89  SUMMARY    109  TOTAL    479     MASS 2.0E+00  UG/CM2  ANAL./T 77.00

BLOCKS     25  TIME 15: 8    OFF-PT.        > 50U      8    > 50U 3.6E-01  UG/CM2   DEAD/T  13.00

TABLE USED TO SCALE DATA

                  RUN PARAMETER TABLE
   MAG    BIN      XL      XU     PARTS  FIELDS  SCALE     MASS

   500     0      0.2     1.0       16   20.00      39  1.06E-02

   500     1      1.0     2.5       71   20.00      39  8.57E-02

   150     2      2.5     5.0      151    3.91      18  4.98E-01

   150     3      5.0    10.0       49    3.91      18  2.67E-01

    50     4     10.0    20.0      115    7.84       1  2.74E-01

    50     5     20.0    50.0       77    7.84       1  9.07E-01



                                  SIZE DISTRIBUTION

   TYPE             0.2-1    1-2.5    2.5-5    5-10     10-20     +20       PART/CM2   %TOTAL
    QUARTZ...           0       87        6       6         1       0        1.2E+03      2.9
    KAOLINITE           0       28       38      29         4       1        2.9E+03      6.6
    ILLITE...          41       42       17       0         0       0        1.8E+03      4.2
    ORGSULF..           0      100        0       0         0       0        2.8E+02      0.6
    PYJAR....           0       60       40       0         0       0        7.1E+02      1.6
    PYRITE...           8       26       57       5         2       2        1.2E+04     27.5
    HALITE...           0        0       12      88         0       0        6.4E+02      1.5
    SIDERITE.           0        0        0      95         0       5        7.5E+01      0.2
    RUTILE...           0        0      100       0         0       0        7.1E+01      0.2
    MONTMORIL           0      100        0       0         0       0        1.5E+02      0.4
    FE-SUL...           0       57       26       0         4      12        2.6E+02      0.6
    QUARORG..          95        0        4       0         0       0        1.6E+03      3.7
    QUARPYR..          68       31        0       0         1       1        6.5E+02      1.5
    MIXSIL...          45       39       11       5         0       0        4.4E+03     10.0
    MIXSUL...           0        0       33      67         0       0        2.1E+02      0.5
    UNKCHLOR.           0        0       33      67         0       0        6.3E+02      1.5
    APATITE..           0        0        0       0        50      50        1.6E+01      0.0
    NOT-INT..          37       46       12       4         0       0        8.1E+03     18.4
    UNKNOWN..          91        4        3       2         0       0        7.9E+03     18.1

    TOTAL....          36       29       25       8         1       1        4.4E+04    100.0
```

```
SAMPLE: 268 06 COMP#1       0.45 - 1.35 m

NUMBER     1  DISK   198     FILE 111 - 115  PARTICLES                          RUN/T  204.00

RUN        1  DATE  1/12/89  SUMMARY   114   TOTAL   555     MASS 1.5E+00  UG/CM2  ANAL./T 93.99

BLOCKS    28  TIME 11:38     OFF-PT.       ) 50U      4    ) 50U 2.0E-01  UG/CM2  DEAD/T 110.00

                                       WEIGHT DISTRIBUTION

              TYPE          0.2-1   1-2.5   2.5-5   5-10    10-20    +20    TOTAL

               QUARTZ...       2      59      16      11      12      0      8.7

               KAOLINITE       5      40      20      23      13      0     10.5

               ILLITE...       7      68      19       2       5      0      7.4

               PYRITE...       0       0       5       5      43     47     25.7

               CALCITE..       0       0      18      20      54      8      7.8

               QUARORG..      46      42       3       9       0      0      1.8

               QUARPYR..      23      26       6      23       7     16      2.9

               MIXSIL...       9      57       5      13      10      5     12.6

               NOT-INT..       2      53      12      12       9     11     15.1

               UNKNOWN..      16      32      24      13       9      5      4.1

               MISC.....       0      25      10       0      54     12      3.4

               TOTAL....       5      33      12      11      23     16    100.0


                                     AVERAGE COMPOSITION
                TYPE         AVE      NA    MG    AL    SI     S    CL     P     K    CA    TI    FE    WT%
               QUARTZ...     1.73      0     1          92     1     2           2     1     1     1    8.7
               KAOLINITE     1.38            0    40    48     2     3           2     1     2     3   10.5
               ILLITE...     0.77      1     0    33    45     4     4           8     1     1     3    7.4
               ORGSULF..    11.83      0           2     0    74                 1           1    21    0.2
               PYJAR....     5.17      1     1     2     1    65                 2     0     0    27    0.9
               PYRITE...     9.54      0     1     3     2    63                 0     0     2    30   25.7
               CALCITE..     6.42            0     2     2     1     2     2     1    88     1     2    7.8
               RUTILE...     1.53                  6     8     3     4           1     0    77     0    0.9
               MONTMORIL     3.79      1          24    68           2           3     2                0.1
               FE-SUL...    16.75            0     2     2    47                 1     1     1    45    1.2
               QUARORG..     0.57      1     0    50    24    11     6     0     1     2     4     0    1.8
               QUARPYR..     0.58      1          47    19     7     8     1     6     3     3     6    2.9
               MIXSIL...     0.91      1          33    46     3     3     0     6     1     2     6   12.6
               UNKCHLOR.    12.30      1     2     6                84                 2           4    0.1
               NOT-INT..     1.03      2     2    23    28     9    16     4     3     6     3    13   15.1
               UNKNOWN..     1.09      1     1    47    21     4    11     2     2     3     5     4    4.1
```

```
SAMPLE: 268 06 COMP#1       0.45 - 1.35 m

NUMBER     1  DISK   198     FILE 111 - 115  PARTICLES                            RUN/T  204.00

RUN        1  DATE  1/12/89  SUMMARY   114   TOTAL   555    MASS 1.5E+00  UG/CM2  ANAL./T 93.99

BLOCKS    28  TIME 11:38     OFF-PT.        ) 50U      4    ) 50U 2.0E-01 UG/CM2  DEAD/T 110.00

TABLE USED TO SCALE DATA

                    RUN PARAMETER TABLE
  MAG     BIN     XL      XU      PARTS  FIELDS  SCALE    MASS

  500      0      0.2     1.0       29    5.00     143  6.93E-02

  500      1      1.0     2.5      130    5.00     143  4.87E-01

  150      2      2.5     5.0      156    6.50       9  1.68E-01

  150      3      5.0    10.0       44    6.50       9  1.62E-01

   50      4     10.0    20.0      168    7.17       1  3.39E-01

   50      5     20.0    50.0       28    7.17       1  2.36E-01



                              SIZE DISTRIBUTION

  TYPE           0.2-1    1-2.5   2.5-5   5-10    10-20     +20       PART/CM2   %TOTAL
   QUARTZ...       21       72       5      1       0        0        1.4E+04     5.4
   KAOLINITE       53       39       6      2       0        0        2.3E+04     8.4
   ILLITE...       66       32       2      0       0        0        4.6E+04    16.6
   ORGSULF..        0        0       0      0     100        0        1.8E+01     0.0
   PYJAR....        0        0      79      0      21        0        1.1E+02     0.0
   PYRITE...        0        0      40     17      34       10        7.7E+02     0.3
   CALCITE..        0        0      61     23      16        1        1.1E+03     0.4
   RUTILE...        0       97       3      0       0        0        1.5E+03     0.5
   MONTMORIL        0        0     100      0       0        0        4.3E+01     0.0
   FE-SUL...        0        0       0      0      86       14        3.0E+01     0.0
   QUARORG..       88       11       0      0       0        0        2.9E+04    10.4
   QUARPYR..       93        6       0      0       0        0        2.9E+04    10.5
   MIXSIL...       71       27       1      0       0        0        5.7E+04    20.6
   UNKCHLOR.        0        0       0      0     100        0        6.2E+00     0.0
   NOT-INT..       47       49       3      1       0        0        5.9E+04    21.4
   UNKNOWN..       67       28       4      1       0        0        1.5E+04     5.5

   TOTAL....       64       32       3      1       0        0        2.7E+05   100.0
```

```
SAMPLE: PHALEN 268 06J      1.35 - 1.45 m

NUMBER      1  DISK   197    FILE 111 - 114  PARTICLES                                   RUN/T   99.00

RUN         1  DATE  1/10/89  SUMMARY   113   TOTAL   477    MASS 2.2E+00  UG/CM2   ANAL./T  93.00

BLOCKS     24  TIME  9:54     OFF-PT.        ) 50U     3    ) 50U 1.7E-01  UG/CM2   DEAD/T    5.99

                                    WEIGHT DISTRIBUTION

              TYPE          0.2-1   1-2.5   2.5-5   5-10   10-20    +20   TOTAL

               QUARTZ...       0       2      12     21      35     30     2.8

               KAOLINITE       0       0      13     35      37     15     3.7

               PYJAR....       4      76       8      0      12      0     2.0

               PYRITE...       0       9      10     16      45     19    60.6

               CALCITE..       0       0      10     43      26     21     1.9

               FE-SUL...       0       1       1      8      20     70    11.9

               QUARPYR..       1       6       5     10      26     51     3.7

               MIXSIL...       2      16      13     22      31     17     2.9

               NOT-INT..       0      18      21     16      12     32     4.6

               UNKNOWN..       6       7       5     29      33     21     1.8

               MISC.....       4       2       8     15      22     50     4.2

               TOTAL....       1       9       9     16      37     28   100.0


                                     AVERAGE COMPOSITION
                TYPE        AVE     NA    MG    AL    SI     S    CL     P     K    CA    TI    FE   WT%
               QUARTZ...    4.40           0     0    94     2     1           1     1     0     2   2.8
               KAOLINITE    6.13     1          42    49     3     2           2     2     2     2   3.7
               ILLITE...    1.38     1          26    46     7     2          12     2     1     3   1.0
               PYJAR....    1.65     0     0     2     6    57     0           4     2     1    29   2.0
               PYRITE...    3.01           0     1     1    62                 0     0     0    35  60.6
               SIDERITE.   19.19     0           1     5     7     1           1     0     1    85   1.2
               CALCITE..    6.28     0     1     3     3     2     2     1     0    86     1     2   1.9
               FE-SUL...    7.71     1     0     3     3    48                 1     0     1    45  11.9
               QUARORG..    0.94     0     0    15    39    26     2     0     3     3     2     8   1.3
               QUARPYR..    1.97     0     1    20    25    28                 5     3     2    17   3.7
               MIXSIL...    2.42                24    58     3     2           6     2     2     4   2.9
               MIXSUL...   21.97                       3    49     1           1     6          40   0.3
               APATITE..   16.40     0     0     1                 1    26     2    68     0     2   0.5
               NOT-INT..    2.29     2     2    29    27    12     4     2     6     6     4    12   4.6
               UNKNOWN..    0.51     0     0    18    39    11     4           6    10     4     5   1.8
```

```
SAMPLE: PHALEN 268 06J        1.35 - 1.45 m

NUMBER     1  DISK   197    FILE 111 - 114  PARTICLES                        RUN/T   99.00

RUN        1  DATE  1/10/89  SUMMARY   113   TOTAL   477    MASS 2.2E+00  UG/CM2  ANAL./T 93.00

BLOCKS    24  TIME  9:54    OFF-PT.        ) 50U     3   ) 50U 1.7E-01  UG/CM2  DEAD/T   5.99

TABLE USED TO SCALE DATA

                    RUN PARAMETER TABLE
  MAG    BIN     XL      XU      PARTS  FIELDS  SCALE    MASS

  500     0     0.2     1.0       11   11.00      31  1.53E-02

  500     1     1.0     2.5       69   11.00      31  1.95E-01

  150     2     2.5     5.0      136    7.10       4  2.00E-01

  150     3     5.0    10.0       64    7.10       4  3.46E-01

   50     4    10.0    20.0      153    3.47       1  7.92E-01

   50     5    20.0    50.0       44    3.47       1  6.01E-01




                          SIZE DISTRIBUTION

  TYPE          0.2-1   1-2.5   2.5-5   5-10   10-20    +20     PART/CM2  %TOTAL
   QUARTZ...       0      36      41     15      6       1     7.7E+02     1.4
   KAOLINITE       0       0      53     35     11       1     8.8E+02     1.6
   ILLITE...      82       0      10      7      1       0     2.1E+03     3.9
   PYJAR....      24      74       2      0      0       0     3.7E+03     6.9
   PYRITE...      12      61      15      6      6       1     1.6E+04    29.7
   SIDERITE.       0       0       0      0     38      62     2.9E+01     0.1
   CALCITE..       0       0      46     46      6       2     4.2E+02     0.8
   FE-SUL...       0      52       7     18     10      12     1.0E+03     2.0
   QUARORG..      74      22       3      1      0       0     3.9E+03     7.2
   QUARPYR..      52      35       7      4      1       1     2.9E+03     5.5
   MIXSIL...      24      58      10      6      2       0     2.6E+03     4.8
   MIXSUL...       0       0       0      0      0     100     9.3E+00     0.0
   APATITE..       0       0       0      0    100       0     2.7E+01     0.0
   NOT-INT..       0      76      19      3      1       0     5.7E+03    10.5
   UNKNOWN..      96       2       1      1      0       0     1.3E+04    25.5

   TOTAL....      42      39      10      5      3       1     5.4E+04   100.0
```

```
SAMPLE: PHALEN 268 06L        1.50 - 1.65 m

NUMBER     1  DISK   197     FILE 115 - 119  PARTICLES                                  RUN/T  245.00

RUN        1  DATE  1/10/89  SUMMARY   118   TOTAL   541     MASS 9.5E+00  UG/CM2  ANAL./T242.00

BLOCKS    28  TIME 14:12     OFF-PT.         ) 50U     3   ) 50U 1.7E+00  UG/CM2  DEAD/T   2.99

                                      WEIGHT DISTRIBUTION

          TYPE             0.2-1   1-2.5   2.5-5   5-10   10-20    +20   TOTAL

           QUARTZ...          0       1      56     36      2      4     6.2

           KAOLINITE          0       3      31     14     31     20     3.5

           ILLITE...          1       2      44     51      2      0     4.5

           PYRITE...          0       2      26     41     18     13    68.6

           FE-SUL...          0       1      24      0     36     39     1.8

           QUARORG..          1      10      43     45      0      0     2.5

           QUARPYR..          3      10      29     44      2     12     2.4

           MIXSIL...          1       4      17      0     20     57     1.6

           NOT-INT..          0       5      34     48      1     11     5.5

           UNKNOWN..          3       5      29      0      4     58     1.5

           MISC.....          1      11      48     19     10     12     1.9

           TOTAL....          0       3      30     38     15     14   100.0


                                      AVERAGE COMPOSITION
         TYPE          AVE      NA    MG    AL    SI     S    CL     P     K    CA    TI    FE   WT%
        QUARTZ...     3.80       0           0    91     2     2           1     0     1     2   6.2
        KAOLINITE     4.14       1          42    48     3     2           2     2     2     2   3.5
        ILLITE...     2.31       1     0    28    48     4     3          12     1     1     3   4.5
        ORGSULF..     1.23       2           5    16    58                 2                16   0.0
        PYJAR....     3.47       0     0     2     7    57     1           4     1     1    26   1.2
        PYRITE...     4.27       0     0     1     2    62                 1     1     1    33  68.6
        SIDERITE.     1.52       1     4     4     2     8     1                            79   0.0
        CALCITE..     2.78             2     1     2     0     2     4     0    78     2     2   0.4
        FE-SUL...     5.79                   2     2    49                 1     0     1    44   1.8
        QUARORG..     1.83       1     1    15    46    16     3          10     2     4     1   2.5
        QUARPYR..     1.28                  37    22    21     1           4     4     1    10   2.4
        MIXSIL...     1.90       0     0    24    56     4     2           6     2     2     3   1.6
        MIXSUL...     1.40       1     0     2    13    43     1           5    12     1    22   0.0
        APATITE..     3.31       1     1     2     1           3    20     1    68     2     2   0.3
        NOT-INT..     2.48       1     1    20    34    15     3     2     8     7     5     6   5.5
        UNKNOWN..     1.65       1     1    12     9     8     3    14     3    41     6     4   1.5
```

```
 SAMPLE: PHALEN 268-06    1.50 - 1.65 m
NUMBER    1 DISK   197    FILE 115 - 119  PARTICLES                           RUN/T  245.00

RUN       1 DATE  1/10/89 SUMMARY   118   TOTAL    541     MASS 9.5E+00  UG/CM2  ANAL./T242.00

BLOCKS   28 TIME 14:12    OFF-PT.         ) 50U      3   ) 50U 1.7E+00  UG/CM2  DEAD/T   2.99

TABLE USED TO SCALE DATA

                  RUN PARAMETER TABLE
  MAG    BIN     XL      XU     PARTS  FIELDS  SCALE    MASS

  500     0     0.2     1.0       31   12.00      16  3.69E-02

  500     1     1.0     2.5      113   12.00      16  2.42E-01

  150     2     2.5     5.0      147    0.57      31  2.80E+00

  150     3     5.0    10.0       54    0.57      31  3.54E+00

   50     4    10.0    20.0      152    2.00       1  1.42E+00

   50     5    20.0    50.0       44    2.00       1  1.27E+00



                             SIZE DISTRIBUTION

 TYPE             0.2-1   1-2.5   2.5-5   5-10    10-20    +20      PART/CM2   %TOTAL
  QUARTZ...          4       5      74     17        0       0      1.6E+04      8.7
  KAOLINITE          0      28      59      7        5       1      6.9E+03      3.6
  ILLITE...         50       7      29     14        0       0      2.0E+04     10.6
  ORGSULF..          0     100       0      0        0       0      4.0E+02      0.2
  PYJAR....          0      41      38     19        1       0      2.5E+03      1.3
  PYRITE...         11      15      47     24        3       1      5.9E+04     30.6
  SIDERITE.          0     100       0      0        0       0      2.5E+02      0.1
  CALCITE..          0      41      57      0        0       2      8.5E+02      0.4
  FE-SUL...          0      18      68      0       10       4      1.4E+03      0.7
  QUARORG..         42      26      25      7        0       0      1.9E+04     10.2
  QUARPYR..         71      13      10      6        0       0      2.5E+04     13.2
  MIXSIL...         49      23      26      0        1       1      6.0E+03      3.1
  MIXSUL...         41      59       0      0        0       0      9.7E+02      0.5
  APATITE..          0       0      98      0        2       0      9.8E+02      0.5
  NOT-INT..         31      23      35     10        0       0      2.3E+04     11.9
  UNKNOWN..         50      24      25      0        0       1      8.5E+03      4.4

  TOTAL....         30      17      38     13        1       0      1.9E+05    100.0
```

```
SAMPLE: 268 06 COMP#2          1.65 - 1.98 m

NUMBER     1  DISK   198     FILE 116 - 120  PARTICLES                                RUN/T  154.99

RUN        1  DATE  1/12/89  SUMMARY   119   TOTAL   591     MASS 4.5E+00  UG/CM2   ANAL./T153.00

BLOCKS    30  TIME 16:14     OFF-PT.        ) 50U      9    ) 50U 1.0E+00  UG/CM2   DEAD/T   1.99

                                       WEIGHT DISTRIBUTION

            TYPE            0.2-1    1-2.5    2.5-5    5-10     10-20     +20    TOTAL

             QUARTZ...        0        7        9       20       22       42      3.4

             KAOLINITE        3       13       42       24        4       14      2.2

             ILLITE...        6       23       15       26       10       19      2.4

             PYJAR....       13       37        4       12       33        0      1.7

             PYRITE...        0        8       10       20       44       17     56.8

             CALCITE..        0        0        5        0        0       95      1.5

             FE-SUL...        0        3        2       14       24       56      4.9

             QUARORG..        3       20       33       30       13        0      1.8

             QUARPYR..        3       11       13       10       24       39      8.1

            MIXSIL...         7       13       10       13        7       51      5.0

            NOT-INT..         0       19       36       11       13       22      2.3

            UNKNOWN..         2        6       11        5       12       65      7.6

            MISC.....         4       17        5       21       14       40      2.3

            TOTAL....         1       10       11       17       32       28    100.0


                                      AVERAGE COMPOSITION
            TYPE          AVE       NA     MG     AL     SI      S      CL      P      K      CA     TI     FE    WT%
           QUARTZ...     2.62       0             1     90      2       1             1      2      1      2    3.4
           KAOLINITE     1.73       1            40     46      4       0             2      2      2      4    2.2
           ILLITE...     1.26       0            26     46      5       1            12      4      2      5    2.4
           ORGSULF..     1.07       1      4      4      3     68       2             5      3      2     10    0.1
           PYJAR....     1.21       1      0      4      7     56                     3      2      2     26    1.7
           PYRITE...     3.41              0      1      2     62                     1      1      1     32   56.8
           SIDERITE.     2.51       0      1      1      4     14                     0      0      2     76    0.3
           CALCITE..     9.05              1      2      3      1              1      3     87      1      3    1.5
           RUTILE...    27.24       1             7     10      2                     1            76      3    0.6
           FE-SUL...     5.19       0      1      2      2     50                     1      1      1     44    4.9
           QUARORG..     1.79       1      1     44     27     13       2      0      4      4      2      3    1.8
           QUARPYR..     1.33       0      0     18     29     27       2      0      4      5      2     17    8.1
          MIXSIL...      0.54       0            20     58      5       2             9      0      2      3    5.0
          MIXSUL...      1.23                     6     10     38                     2      6      1     36    1.1
          APATITE..      1.52              0      6                            23      3     65             4    0.1
          NOT-INT..      2.29       1      1     31     22     12       3      4      5      8      4      9    2.3
          UNKNOWN..      1.22       0            20     16      9       1      9      4     30      2      9    7.6
```

```
SAMPLE: 268 06 COMP#2   1.65 1.98 m

NUMBER      1  DISK   198     FILE 116 - 120  PARTICLES                            RUN/T  154.99

RUN         1  DATE  1/12/89  SUMMARY    119  TOTAL    591     MASS 4.5E+00  UG/CM2  ANAL./T153.00

BLOCKS     30  TIME 16:14     OFF-PT.         ) 50U      9   ) 50U 1.0E+00  UG/CM2  DEAD/T   1.99

TABLE USED TO SCALE DATA

                      RUN PARAMETER TABLE
   MAG    BIN     XL      XU      PARTS  FIELDS  SCALE    MASS

   500     0      0.2     1.0       43    9.24      21  6.08E-02

   500     1      1.0     2.5      157    9.24      21  4.19E-01

   150     2      2.5     5.0      145    2.65       6  5.01E-01

   150     3      5.0    10.0       54    2.65       6  7.61E-01

    50     4     10.0    20.0      145    2.02       1  1.40E+00

    50     5     20.0    50.0       47    2.02       1  1.24E+00




                                    SIZE DISTRIBUTION

    TYPE            0.2-1    1-2.5    2.5-5    5-10    10-20     +20      PART/CM2   %TOTAL
     QUARTZ...          0       75       14       8        2       1       3.9E+03      1.9
     KAOLINITE         44       35       17       3        0       0       9.3E+03      4.5
     ILLITE...         67       26        4       3        0       0       1.5E+04      7.4
     ORGSULF..         65       35        0       0        0       0       2.8E+03      1.4
     PYJAR....         63       34        1       1        1       0       8.9E+03      4.3
     PYRITE...          6       59       18      10        6       1       2.7E+04     13.2
     SIDERITE.          0       74       23       0        3       0       4.5E+02      0.2
     CALCITE..          0        0       87       0        0      13       1.2E+02      0.1
     RUTILE...          0        0        0       0        0     100       1.5E+01      0.0
     FE-SUL...          0       66        7      14        7       6       1.5E+03      0.7
     QUARORG..         42       41       13       3        1       0       7.2E+03      3.5
     QUARPYR..         61       29        7       1        1       0       2.8E+04     14.0
     MIXSIL...         90        8        1       1        0       0       6.6E+04     32.4
     MIXSUL...         59       37        0       4        0       0       5.5E+03      2.7
     APATITE..          0       77       23       0        0       0       5.5E+02      0.3
     NOT-INT..          0       66       31       2        0       0       6.3E+03      3.1
     UNKNOWN..         71       19        8       1        0       1       2.0E+04     10.1

     TOTAL....         59       29        8       3        1       0       2.0E+05    100.0
```